Section 6.0
Adjustment/Verification Procedures

Overview

Various procedures in this section must be performed after a repair has been made to the pump. The repair procedures listed in Section 5 determine when a procedure must be performed.

Cautions:

Electronic components may be damaged by static electricity discharges. Open the case and perform testing only at an ESD controlled work station using an electrically dissipative grounded mat and wrist strap.

To avoid risk of electric shock, do not come into contact with the primary AC circuitry on the power supply mounted on the rear case at any time AC power is applied.

To avoid damage to electronic components, unplug the AC power cord and remove the battery fuse to electrically disconnect the battery whenever removing circuit boards.

The rear case must be positioned away from the front case during testing to assure that the rear case does not short out on the pump module circuit board for Channel 1.

Verify that the rubber gasket between the two case halves is in place before closing the case. If the gasket is not installed, fluid could enter the unit or the unit could become susceptible to static discharges. Either of these conditions could result in erratic operation of the pump.

Prior to closing the case, verify that all the circuit boards are fully seated, that the ribbons cables connecting the Pump Modules to the Microprocessor Boards are fully seated, and that all wires are dressed such that they do not interfere with any moving parts in the pump and are clear of pinch points when the case halves mate.

Microprocessor Board

Equipment Required:

- Digital Multimeter (DMM)
- Frequency Counter
- Microprocessor Extender Board (optional)
- 1/4" Stereo Phone Plug
- Primed IV Set

Setup:

1. Disconnect the pump from AC power and remove the battery fuse.
2. If desired, remove the appropriate Microprocessor Board and place it on the extender board.
3. Reinstall the battery fuse.
4. Connect the pump to AC power.
5. Hang the fluid container 6 to 24 inches above the cassette door. Install the primed IV set in the channel to be tested and close the cassette door. Open the roller clamp.
6. Press the POWER key to turn on the channel.

Procedure:

Caution: To prevent the risk of electrical shock, do not come in contact with the primary AC circuitry on the Power Supply mounted on the rear of the case.

Note: Reference all measurements to TP2 (AG) on the Microprocessor Board unless otherwise noted.

Reference Voltages

6.1.1 +5.0 VOLT VREF

1. Connect the DMM to TP14 (VR) on the Microprocessor Board.
2. Verify the voltage is between 4.75 and 5.25 VDC.

6.1.2 +2.50 VOLT REFERENCE

1. Connect the DMM to TP3 (2.5V).
2. Verify the voltage is between 2.48 and 2.52 VDC.

Time Base Check

6.1.3 TIME BASE CHECK CLOCK

1. Connect the Frequency Counter to TP6 (1.5M).
2. Verify the frequency is between 1498500 and 1501500 Hz.

Watchdog Timers

6.1.4 PRIMARY WATCHDOG TIMER

1. Verify that the channel power is on. Connect a jumper wire from TP1 (GND) to TP7 (W1) for approximately one second.
2. Verify that the channel turns off, that the appropriate Channel System Check indicator illuminates, and that the Buzzer sounds.
3. Press the POWER key for the channel. Verify that the buzzer turns off and that the channel turns on.

Note: There is a possibility that a Common System Check alert will be generated when the channel is turned back on. This is not a failure and can be corrected by turning off the channel and turning it back on.

6.1.5 SECONDARY WATCHDOG TIMER

1. Verify that the channel power is on. Connect a jumper wire from TP1 (GND) to TP8 (W2) for one second.
2. Verify that the channel turns off, that the appropriate Channel System Check indicator illuminates, and that the Buzzer sounds.
3. Press the POWER key for the channel. Verify that the alarm turns off and that the channel turns on.

Note: There is a possibility that a Common System Check alert will be generated when the channel is turned back on. This is not a failure and can be corrected by turning off the channel and turning it back on.

Nurse Call

6.1.6 NURSE CALL ALERT

1. Connect a stereo phone plug to the pump NURSE CALL jack. Connect the DMM, configured to measure resistance, to the plug.
2. Set the flow rate to 100.0 ml/hr, press INFUSE ALL to set the VTBI to ALL, and press INFUSE/PAUSE to start infusion.
3. Verify that the resistance is greater than 1 megohm.

Microprocessor Board (cont)

4. Initiate a nurse call by opening the cassette door.

5. Verify that the resistance is less than 5.0 ohms.

6. Close the cassette door to silence the alert.

Battery Voltage Switch

6.1.7 BATTERY VOLTAGE SWITCH (VBAT)

1. Configure the DMM to measure DC voltage and connect the positive lead of the DMM to TP4 (VB) on the Power Management Board.

2. Connect the negative lead of the DMM to TP11 (VB) on the Microprocessor Board. Verify a reading of 0.0 VDC when the channel is turned on.

Battery Current Switch

6.1.8 BATTERY CURRENT SWITCH (IBAT)

1. Configure the DMM to measure DC voltage and connect the positive lead of the DMM to TP5 (IB) on the Power Management Board.

2. Connect the negative lead of the DMM to TP12 (IB) on the Microprocessor Board. Verify a reading of 0.0 VDC when the channel is turned on.

Reassembly:

1. Unplug the unit from AC power and remove the battery fuse.

2. Remove the extender board and reinstall the Microprocessor Board.

3. Close the case per section 5.0.

4. Reinstall the battery fuse.

Note: Prior to placing the pump into clinical use, the following procedure must be performed:

- Periodic Maintenance Procedure, section 3.1.

Pump Module Interface Board

Equipment Required:

- Digital Multimeter (DMM)
- Oscilloscope
- Transducer Simulator with Trilogy Adapter
- Power Management Extender Board
- Variable Regulated Air Source with 30 psi Pressure Gauge
- IV Set with a Valveless Cassette
- Primed IV Set

Procedure:

Caution: To prevent the risk of electrical shock, do not come in contact with the primary AC circuitry on the Power Supply mounted on the rear of the case.

Note: Reference all measurements to TP1-2 (AG) on the Pump Module Interface Board unless otherwise noted.

To improve common mode rejection when checking ripple voltages, disconnect the DMM from the test points, isolate oscilloscope ground from the AC line, and connect the oscilloscope ground probe to TP1-2 (AG). Do not use a oscilloscope ground probe which exceeds 8".

The microprocessor based system generates high amplitude (up to 200 mV P-P) short duration (less than 2 microsecond) pulses at various repetition rates. These pulses are to be ignored when performing ripple voltage measurements.

Motion/Position Sensors

6.2.1 MOTOR MOTION SENSOR

1. Verify that all channels are off, the pump is disconnected from AC power, and the board is removed from the Pump Module and placed on an insulating surface.
2. Connect the ribbon cable to the Pump Module Interface Board.
3. Connect the pump to AC power.
4. Opto switch U8 must have its light path unblocked and not exposed to bright direct light. (Normal room lighting is acceptable).
5. Connect the DMM to TP2-4 (MS). Reference the DMM to TP2-5 (GND). POWER on the channel.
6. If TP2-4 is low (less than 0.5 V), turn R31 (upper potentiometer) counter clockwise until TP2-4 goes high (greater than 4 VDC); if TP2-4 is already high, then continue to the next step.

Pump Module
Interface Board (cont)

7. Turn R31 slowly clockwise just until TP2-4 switches low. Move the floating DMM (DMM common lead must not be tied to AC line ground) to measure the voltage between TP2-1 (MI+) and TP2-2 (MI-). Multiply this voltage by 1.5 and make a written note of it. Turn R31 clockwise until the voltage between TP2-1 and TP2-2 matches the multiplied value. Apply a drop of Glyptol to the adjustment screw of R31.

6.2.2 MOTOR POSITION SENSOR

1. Opto switch U7 must have its light path unblocked as in the motor motion sensor adjustment.
2. Connect the DMM to TP3-4 (PS). Reference the DMM to TP3-5 (GND). POWER on the channel.
3. If TP3-4 is low (less than 0.5 V), turn R32 (lower potentiometer) counter clockwise until TP3-4 goes high (greater than 4 VDC); if TP3-4 is already high, then continue to the next step.
4. Turn R32 slowly clockwise just until TP3-4 switches low. Move the floating DMM (DMM common lead must not be tied to AC line ground) to measure the voltage between TP3-1 (PI+) and TP3-2 (PI-). Multiply this voltage by 1.5 and make a written note of it. Turn R32 clockwise until the voltage between TP3-1 and TP3-2 matches the multiplied value. Apply a drop of Glyptol to the adjustment screw of R32.
5. Turn off power to the channel, disconnect the pump from AC power, and disconnect the ribbon cable. Return to section 5.4, step 5.

Regulated Voltages

6.2.3 +8.0 VOLT REGULATOR

1. POWER on the channel.
2. Connect the DMM to TP1-4 (8V) on the Pump Module Interface Board.
3. Verify the voltage is between 7.20 and 8.80 VDC.
4. Disconnect the DMM.
5. Connect the oscilloscope to TP-4 (8V) on the Pump Module Interface Board.
6. Disconnect the motor from connector P2 on the Pump Module Interface Board.
7. Verify a ripple voltage of less than 25 mV P-P.
8. Reconnect the motor connector to P2 on the Pump Module Interface Board.

Pump Module Interface Board (cont)

Transducer Amplifier

6.2.4 PRESSURE TRANSDUCER SPAN/OFFSET

1. Turn off the channel power. Disconnect the pressure transducer from J3 and connect the transducer simulator (white wire is pin 1). Connect the DMM to TP1-1. Turn on the channel power.

2. Set the transducer simulator switch to the 0 psi position and verify that the voltage is between .82 and 1.16 VDC.

3. Set the transducer simulator switch to the 35 psi position and verify that the voltage is between 3.38 and 3.89 VDC.

4. Turn off the channel power, remove the transducer simulator and reconnect the pressure transducer.

Cassette Door Switch

6.2.5 CASSETTE DOOR SWITCH ADJUSTMENT

1. Insert a cassette into the pump module and close the door. POWER on the appropriate channel.

2. Using a 1/16" Allen wrench, turn the door switch adjustment screw clockwise until the switch de-actuates (*INSERT CASSETTE AND CLOSE DOOR* message appears).

3. Turn the adjustment screw counter clockwise until the switch actuates (message disappears) then turn an additional 1/4 turn counter clockwise.

4. Open the cassette door latch handle approximately 1 inch from the door. Verify that *INSERT CASSETTE AND CLOSE DOOR* scrolls across the message display.

5. Open and close the cassette door several times and verify correct operation.

Motor Torque

6.2.6 MOTOR TORQUE

1. POWER on the appropriate channel.

2. Press SELECT OPTION and ADJUST OPTION simultaneously until *ENTER CODE AND PRESS ADJUST* is scrolled across the display.

3. Enter *663.5* in the FLOW RATE display and press ADJUST OPTION until *BIOMED MODE - NOT FOR CLINICAL USE* is scrolled across the display.

4. Press SELECT OPTION as necessary until *8.MANUAL OPERATION* is scrolled across the display.

5. Press ADJUST OPTION when *NO* is displayed to change the display to *YES* indicating that manual mode is to be enabled.

6. Connect the IV set with the valveless cassette to the air source. Adjust the air source to 0 psi.

7. Insert the cassette into the pump module and close the cassette door.

8. Set the flow rate to 999.9 ml/hr, volume to be infused to ALL, and start infusion.

9. Increase the air pressure to 10 psi and then increase the pressure in 1 psi increments until a clicking noise occurs indicating that the motor can no longer hold against the backpressure. Verify that the clicking noise does not occur at a pressure which is lower than 15 psi.

10. Decrease the pressure to 0 psi and remove the cassette from the pump.

Motor Current

6.2.7 MOTOR CURRENT

1. Disconnect the pump from AC power and remove the battery fuse.

2. Open the case per section 5.0.

3. Remove shorting jumper JPC-7 (C1VMTR), JPC-3 (C2VMTR), or JPC-2 (C3VMTR) from the Power Management Extender Board, depending upon which pump module is being tested.

4. Connect the DMM (2000 maDC range) between the jumper pins.

5. Remove the Power Management Board and place it on the extender board and install the extender board.

6. Reinstall the battery fuse and connect the pump to AC power.

7. Press the POWER key to turn on the appropriate channel.

8. Install a primed IV set into the channel and close the cassette door.

9. Set the flow rate to 100 ml/hr.

10. Press INFUSE/PAUSE to start infusion. The current reading will be stable for approximately 4 seconds during each delivery cycle. Verify that the current is between 40 and 65 mA.

11. Turn off the channel.

Reassembly:

12. Unplug the unit from AC power and remove the battery fuse.

13. Remove the extender board, disconnect the DMM, replace the shorting jumper, and reinstall the Power Management Board.

14. Close the case per section 5.0.

Note: Prior to placing the pump into clinical use, the following procedure must be performed:

- Periodic Maintenance Procedure, section 3.1.

Common Board

Equipment Required:

- Digital Multimeter (DMM)
- Common Extender Board
- Frequency Counter
- Oscilloscope
- 100K Ohm Resistor
- Stereo Phone Plug
- Primed IV Set

Setup:

1. Disconnect the pump from AC power and remove the battery fuse.
2. Remove the Common Board and place it on the extender board.
3. Reinstall the battery fuse.
4. Insert the primed IV set into Channel 1 and close the cassette door.

Procedure:

Caution: To prevent the risk of electrical shock, do not come in contact with the primary AC circuitry on the Power Supply mounted on the rear of the case.

Note: Reference all measurements to TP1-1 (GND) on the Common Board unless otherwise noted.

To improve common mode rejection when checking ripple voltages,disconnect the DMM from the test points, isolate oscilloscope ground from the AC line, and connect the oscilloscope ground probe to TP1-1 (GND). Do not use a oscilloscope ground probe which exceeds 8".

The microprocessor based system generates high amplitude (up to 200 mV P-P) short duration (less than 2 microsecond) pulses at various repetition rates. These pulses are to be ignored when performing ripple voltage measurements.

RAM Battery Voltage

6.3.1 RAM BATTERY VOLTAGE

1. Connect the DMM to TP1-13 (R5V) on the Common Board.
2. Verify the voltage is 2.30 to 3.5 VDC.

   Note: The pump must be disconnected from AC power when performing this test.

3. Connect the pump to AC power. Verify that the voltage at TP1-13 is greater than 4.25 VDC.

-5 VDC Supply

6.3.2 -5 VOLT SUPPLY

1. Connect the DMM to TP1-15 (-5V) on the Common Board.
2. Verify the voltage is between -4.75 and -5.25 VDC.
3. Disconnect the DMM.
4. Connect the oscilloscope to TP1-15 (-5V) on the Common Board.
5. Verify a ripple voltage of less than 100 mV P-P.

Backup Buzzer

6.3.3 BACKUP BUZZER

1. POWER on Channel 1. Open the cassette door on Channel 1. The BingBong alert should commence.
2. Connect a jumper wire from TP1-1 (GND) to TP1-14 (AIN). The BingBong alert should stop. Within less than 60 seconds the buzzer should sound.
3. Remove the jumper wire. Close the cassette door.

Nurse Call Relay

6.3.4 NURSE CALL RELAY

1. Connect a stereo phone plug to the pump NURSE CALL jack. Connect the DMM, configured to measure resistance, to the plug.
2. Press INFUSE/PAUSE on channel 1 to start the infusion. Verify that the resistance is greater than 1 megohm.
3. Initiate a nurse call by opening the cassette door.
4. Verify the resistance is less than 5.0 ohms.
5. POWER off the channel and close the cassette door.
6. Remove the stereo phone plug.

Alarm Volume

6.3.5 ALARM VOLUME CONTROL

1. POWER on a channel and open the cassette door.
2. Press SELECT OPTION until the pump displays *ALARM VOLUME.*
3. Volume is at maximum when the display is filled with ">>>>>>>>". If the volume is not at maximum, press ADJUST OPTION multiple times until the volume is at maximum. Verify that the sound volume is maximum.

4. Press ADJUST OPTION multiple times to decrease the volume to minimum. Verify that the volume decreases as the display level decreases. Volume is at minimum when a single ">" is displayed. Verify that the alarm is still audible at minimum.
5. Return the alarm volume to the normally used level.
6. POWER off the channel and close the cassette door.

Calendar Clock

6.3.6 CALENDAR CLOCK

1. Using jumper wires, connect a 100K ohm resistor between U4 pin 7 and TP1-3 (+5V).
2. Connect the frequency counter to U4 pin 7. Verify a frequency of 0.9 to 1.1 Hz.
3. Remove the jumper wires and resistor.

Time Slot Clock

6.3.7 TIME SLOT CLOCK

1. Connect the frequency counter to TP1-8 (TCK).
2. Verify a frequency of approximately 8 Hz.

Audio Alert Supply

6.3.8 AUDIO ALERT SUPPLY

1. Verify that the pump is connected to AC power.
2. Connect the DMM to TP1-12 (SAV).

   Caution: To prevent damage to the digital electronics, do not short TP1-12 to any of the adjoining pins on TP1.

3. Verify a voltage reading greater than 11.0 VDC.

Depleted Battery Alert

6.3.9 DEPLETED BATTERY ALERT

1. Disconnect the pump from AC power.
2. Turn off all channels and remove the battery fuse.
3. Reinstall the battery fuse.
4. Turn on one channel and verify that a continuous high pitched "beep" alert is active.
5. Turn off the channel.

-5 VDC Supply

6.3.2 -5 VOLT SUPPLY

1. Connect the DMM to TP1-15 (-5V) on the Common Board.
2. Verify the voltage is between -4.75 and -5.25 VDC.
3. Disconnect the DMM.
4. Connect the oscilloscope to TP1-15 (-5V) on the Common Board.
5. Verify a ripple voltage of less than 100 mV P-P.

Backup Buzzer

6.3.3 BACKUP BUZZER

1. POWER on Channel 1. Open the cassette door on Channel 1. The BingBong alert should commence.
2. Connect a jumper wire from TP1-1 (GND) to TP1-14 (AIN). The BingBong alert should stop. Within less than 60 seconds the buzzer should sound.
3. Remove the jumper wire. Close the cassette door.

Nurse Call Relay

6.3.4 NURSE CALL RELAY

1. Connect a stereo phone plug to the pump NURSE CALL jack. Connect the DMM, configured to measure resistance, to the plug.
2. Press INFUSE/PAUSE on channel 1 to start the infusion. Verify that the resistance is greater than 1 megohm.
3. Initiate a nurse call by opening the cassette door.
4. Verify the resistance is less than 5.0 ohms.
5. POWER off the channel and close the cassette door.
6. Remove the stereo phone plug.

Alarm Volume

6.3.5 ALARM VOLUME CONTROL

1. POWER on a channel and open the cassette door.
2. Press SELECT OPTION until the pump displays *ALARM VOLUME.*
3. Volume is at maximum when the display is filled with ">>>>>>>>". If the volume is not at maximum, press ADJUST OPTION multiple times until the volume is at maximum. Verify that the sound volume is maximum.

4. Press ADJUST OPTION multiple times to decrease the volume to minimum. Verify that the volume decreases as the display level decreases. Volume is at minimum when a single ">" is displayed. Verify that the alarm is still audible at minimum.
5. Return the alarm volume to the normally used level.
6. POWER off the channel and close the cassette door.

Calendar Clock

6.3.6 CALENDAR CLOCK

1. Using jumper wires, connect a 100K ohm resistor between U4 pin 7 and TP1-3 (+5V).
2. Connect the frequency counter to U4 pin 7. Verify a frequency of 0.9 to 1.1 Hz.
3. Remove the jumper wires and resistor.

Time Slot Clock

6.3.7 TIME SLOT CLOCK

1. Connect the frequency counter to TP1-8 (TCK).
2. Verify a frequency of approximately 8 Hz.

Audio Alert Supply

6.3.8 AUDIO ALERT SUPPLY

1. Verify that the pump is connected to AC power.
2. Connect the DMM to TP1-12 (SAV).

   Caution: To prevent damage to the digital electronics, do not short TP1-12 to any of the adjoining pins on TP1.

3. Verify a voltage reading greater than 11.0 VDC.

Depleted Battery Alert

6.3.9 DEPLETED BATTERY ALERT

1. Disconnect the pump from AC power.
2. Turn off all channels and remove the battery fuse.
3. Reinstall the battery fuse.
4. Turn on one channel and verify that a continuous high pitched "beep" alert is active.
5. Turn off the channel.

Reassembly:

1. Unplug unit from AC power and remove battery fuse.
2. Remove the extender board and reinstall the Common Board.
3. Close the case per section 5.0.
4. Reinstall the battery fuse.

Note: Prior to placing the pump into clinical use, the following procedure must be performed:

- Periodic Maintenance Procedure, section 3.1.

Power Management Board

Equipment Required:

- Digital Multimeter (DMM)
- Oscilloscope
- Frequency Counter
- Power Management Extender Board
- 3 Primed IV Sets

Setup:

1. Disconnect the pump from AC power and remove the battery fuse.
2. Remove the Power Management Board and place it on the Power Management Extender Board.
3. Reinstall the battery fuse.
4. In each of the 3 pump modules, install a primed IV set cassette with a container fluid level of 6 to 24 inches above the cassette door, and close the door. Open the roller clamps.
5. Press the POWER keys on the pump front panel to turn all 3 channels on. If necessary, press QUIET ALARM every two minutes. Do NOT press the Infuse/Pause key on any channel.

Procedure:

Caution: To prevent the risk of electrical shock, do not come in contact with the primary AC circuitry on the Power Supply mounted on the rear of the case.

Notes: Reference all measurements to TP1-3 (AG) on the Power Management Board unless otherwise noted.

To improve common mode rejection when checking ripple voltages, disconnect the DMM from the test points, isolate oscilloscope ground from the AC line, and connect the oscilloscope ground probe to TP1-3 (AG). Do not use a oscilloscope ground probe which exceeds 8".

The microprocessor based system generates high amplitude (up to 200 mV P-P) short duration (less than 2 microsecond) pulses at various repetition rates. These pulses are to be ignored when performing ripple voltage measurements.

Regulated Voltages

6.4.1 +12 VOLT MOTOR

1. Connect the DMM to TP1-12 (VM) on the Power Management Board.
2. Verify the voltage is between 11.50 and 12.50 VDC.

   Note: The pump must be disconnected from AC power when performing this test.
3. Disconnect the DMM.
4. Connect the oscilloscope to TP1-12 (VM) on the Power Management Board.
5. Verify a ripple voltage of less than 200 mV P-P.
6. POWER off all three channels.
7. Connect the pump to AC power.

6.4.2 +5.0 VOLT CHANNEL 1

1. Connect the DMM to TP1-13 (V1) on the Power Management Board.
2. Connect a jumper wire between TP3 (2.5V) and TP1 (GND) on Channel 1 Microprocessor Board. POWER on Channel 1 and verify that Channel 1 initiates a system check alert and that the displays for Channel 1 turn off. (This eliminates motor drive pulses and display multiplexing effects for the ripple measurement).
3. Verify the voltage is between 4.85 and 5.15 VDC.
4. Disconnect the DMM.
5. Connect the oscilloscope to TP1-13 (V1) on the Power Management Board.
6. Verify a ripple voltage of less than 100 mV P-P.
7. POWER off Channel 1. Remove the jumper wire.

6.4.3 +5.0 VOLT CHANNEL 2

1. Connect the DMM to TP1-14 (V2) on the Power Management Board.
2. Connect a jumper wire between TP3 (2.5V) and TP1 (GND) on Channel 2 Microprocessor Board. POWER on Channel 2 and verify that Channel 2 initiates a system check alert and that the displays for Channel 2 turn off. (This eliminates motor drive pulses and display multiplexing effects for the ripple measurement).
3. Verify the voltage is between 4.85 and 5.15 VDC.

4. Disconnect the DMM.
5. Connect the oscilloscope to TP1-14 (V2) on the Power Management Board.
6. Verify a ripple voltage of less than 100 mV P-P.
7. POWER off Channel 2. Remove the jumper wire.

6.4.4 +5.0 VOLT CHANNEL 3

1. Connect the DMM to TP1-15 (V3) on the Power Management Board.
2. Connect a jumper wire between TP3 (2.5V) and TP1 (GND) on Channel 3 Microprocessor Board. POWER on Channel 3 and verify that Channel 3 initiates a system check alert and that the displays for Channel 3 turn off. (This eliminates motor drive pulses and display multiplexing effects for the ripple measurement).
3. Verify the voltage is between 4.85 and 5.15 VDC.
4. Disconnect the DMM.
5. Connect the oscilloscope to TP1-15 (V3) on the Power Management Board.
6. Verify a ripple voltage of less than 100 mV P-P.
7. POWER off Channel 3. Remove the jumper wire.

6.4.5 +5.0 VOLT COMMON

1. Connect the DMM to TP1-9 (+5) on the Power Management Board.
2. Verify the voltage is between 4.85 and 5.15 VDC.
3. Disconnect the DMM.
4. Connect the oscilloscope to TP1-9 (+5) on the Power Management Board.
5. Verify a ripple voltage of less than 100 mV P-P.

6.4.6 +5.0 VOLT STANDBY

1. Connect the DMM to TP1-8 (5S) on the Power Management Board.
2. Verify the voltage is between 4.85 and 5.15 VDC.
3. Disconnect the DMM.
4. Connect the oscilloscope to TP1-8 (5S) on the Power Management Board.
5. Verify a ripple voltage of less than 100 mV P-P.

6.4.7 +15.0 VOLT POWER MANAGEMENT

1. Connect the DMM to TP1-10 (15) on the Power Management Board.
2. Verify the voltage is between 14.25 and 15.75 VDC.
3. Disconnect the DMM.
4. Connect the oscilloscope to TP1-10 (15) on the Power Management Board.
5. Verify a ripple voltage of less than 100 mV P-P.

6.4.8 -5.0 VOLT POWER MANAGEMENT

1. Connect the DMM to TP1-11 (-5) on the Power Management Board.
2. Verify the voltage is between -4.75 and -5.25 VDC.
3. Disconnect the DMM.
4. Connect the oscilloscope to TP1-11 (-5) on the Power Management Board.
5. Verify a ripple voltage of less than 100 mV P-P.

Motor Drivers

6.4.9 CHANNEL 1 MOTOR VOLTAGE

1. POWER on all channels.
2. Connect the DMM to TPC-7 (C1VMTR) on the Power Management Extender Board.

   Caution: To prevent damage to the electronic circuits, do not short TPC-7 to any of the adjacent pins.

3. Verify the voltage is greater than 11.00 VDC.

6.4.10 CHANNEL 2 MOTOR VOLTAGE

1. Connect the DMM to TPC-3 (C2VMTR) on the Power Management Extender Board.

   Caution: To prevent damage to the electronic circuits, do not short TPC-3 to any of the adjacent pins.

2. Verify the voltage is greater than 11.00 VDC.

6.4.11 CHANNEL 3 MOTOR VOLTAGE

1. Connect the DMM to TPC-2 (C3VMTR) on the Power Management Extender Board.

   Caution: To prevent damage to the electronic circuits, do not short TPC-2 to any of the adjacent pins.

2. Verify the voltage is greater than 11.00 VDC.

Off/On Currents

6.4.12 OFF CURRENT

1. Turn all channels off and unplug the AC power cord.
2. Disconnect the DMM from the previous test point and configure it to measure current.
3. Remove shorting jumpers JPB-5 (BAT-) and JPC-5 (BAT-) from the Power Management Extender Board and connect the DMM (2 maDC range) between the jumper pins on JPB-5.
4. Verify the current is less than 1.0 mA.

6.4.13 ON CURRENT

1. Connect the DMM (2000 mADC range) as in OFF CURRENT test.
2. With the AC power cord unplugged, POWER on each channel.
3. Set the flow rate to 999.9 ml/hr and the volume to be infused to ALL. Press Infuse/Pause to start infusing on all channels.
4. Verify that the highest current, after the power on display test is completed, is less than 1100 mA.

Battery Charge Circuitry

6.4.14 BATTERY CHARGE CURRENT

1. Plug in the AC power cord and connect the DMM as in ON CURRENT test.
2. Verify that the current is between 350 and 500 mA for assemblies built to revision D or lower. Verify that the current is between 900 and 1200 mA for assemblies built to revision E or higher.

   Note: If the battery is fully charged, this current will soon taper off. If this happens unplug the AC power cord for a few seconds and repeat the test.

3. Disconnect the DMM.
4. Replace both shorting jumpers.

6.4.15 BATTERY VOLTAGE AMPLIFIER

1. With the AC power cord unplugged, turn on one channel.
2. Connect the DMM negative lead to TP1-4 (VB) and the positive lead to TP1-16 (B+) and verify that the voltage is between 5.90 and 6.10 VDC.

6.4.16 BATTERY CURRENT AMPLIFIER

1. Turn on the other two channels.
2. Connect the negative lead of the DMM to TP1-1 (GND).
3. Connect the DMM to TP1-17 (B-), note the voltage, and immediately move the DMM to TP1-5 (IB).
4. Verify that the voltage is within .1 volt of 25 times the voltage at TP1-17 previously noted.

   Note: The voltages measured are changing with the current. It may be necessary to repeat the measurements to obtain two readings at about the same battery current. An alternative is to use two meters to observe the voltages simultaneously.

6.4.17 BATTERY SENSE CIRCUIT

1. Connect the pump to AC power. Turn off all channels.
2. Connect an oscilloscope with the input AC coupled to TP1-5 (IB).
3. Verify a pulse of at least 5 mV in amplitude and 0.5 to 2.0 msec in duration with a frequency of about 8 HZ.

6.4.18 BATTERY CURRENT VOLTAGE TO FREQUENCY CONVERTER

1. Verify that the pump is connected to AC power.
2. Connect the DMM to TP1-5 (IB).
3. Connect a frequency counter to the signal at TP1-6 (CF). Connect a jumper wire from TP1-5 (IB) to TP1-9 (+5). Verify a frequency at TP1-6 of (7457 times the voltage at TP1-5) Hz +/-1000 Hz. If necessary, adjust R1 to meet the frequency specification.

   Caution: Keep the jumper wire attached only long enough to obtain the frequency reading. Damage to the operational amplifier could occur if it is kept in place too long.

4. Apply a drop of Glyptol to the adjustment screw of R1 if an adjustment was performed.

6.4.19 VBAT/IBAT SWITCH CONTROL SIGNALS

1. Power off all channels.
2. Configure the DMM to measure DC voltage and connect the positive lead of the DMM to TP1-4 (VB) on the Power Management Board.
3. Connect the negative lead of the DMM to TP11 (VB) on channel 1 Microprocessor Board.
4. POWER on Channel 1 and verify a reading of 0.0 VDC. POWER off Channel 1.

Power Management Board (cont)

5. Move the negative lead of the DMM to TP11 (VB) on Channel 2 Microprocessor Board.
6. POWER on Channel 2 and verify a reading of 0.0 VDC. POWER off Channel 2.
7. Move the negative lead of the DMM to TP11 (VB) on Channel 3 Microprocessor Board.
8. POWER on Channel 3 and verify a reading of 0.0 VDC. POWER off Channel 3.
9. Disconnect the DMM.

System Check Indicators and Buzzer

6.4.20 CHANNEL SYSTEM CHECK INDICATORS AND BUZZER

1. POWER on Channel 1.
2. Connect a jumper wire from TP1 (GND) to TP7 (W1) on Channel 1 Microprocessor Board for approximately one second .
3. Verify that Channel 1 turns off, that Channel 1 System Check indicator illuminates and that the buzzer sounds.
4. Open Channel 1 cassette door. Verify that the buzzer is silenced. Close the cassette door.
5. POWER on and then off Channel 1.
6. POWER on Channel 2.
7. Connect a jumper wire from TP1 (GND) to TP7 (W1) on Channel 2 Microprocessor Board for approximately one second .
8. Verify that Channel 2 turns off, that Channel 2 System Check indicator illuminates and that the buzzer sounds.
9. Open Channel 2 cassette door. Verify that the buzzer is silenced. Close the cassette door.
10. POWER on and then off Channel 2.
11. POWER on Channel 3.
12. Connect a jumper wire from TP1 (GND) to TP7 (W1) on Channel 3 Microprocessor Board for approximately one second .
13. Verify that channel turns off, that Channel 3 System Check indicator illuminates and that the buzzer sounds.
14. Open Channel 3 cassette door. Verify that the buzzer is silenced. Close the cassette door.
15. POWER on and then off Channel 3.

6.4.21 NURSE CALL ALERT

1. Connect a stereo phone plug to the pump NURSE CALL jack. Connect the DMM, configured to measure resistance, to the plug.
2. POWER on Channel 1.
3. Press INFUSE/PAUSE to start infusion. Verify that the resistance is greater than 1 megohms.
4. Connect a jumper wire from TP1 (GND) to TP7 (W1) on Channel 1 Microprocessor Board for approximately one second .
5. Verify that the resistance is now less than 5.0 ohms.
6. POWER on and then off Channel 1.

Reassembly:

1. Unplug unit from AC power and remove battery fuse.
2. Remove the extender board and reinstall the Power Management Board.
3. Close the case per Section 5.0.
4. Reinstall the battery fuse.

Note: Prior to placing the pump into clinical use, the following procedure must be performed:

- Periodic Maintenance Procedure, section 3.1.

Rear Case Assembly

Equipment Required:

- Digital Multimeter (DMM)
- 24 VDC Power Supply
- 1 K ohm Resistor
- Oscilloscope
- Power Management Extender Board

Procedure:

Caution: To prevent the risk of electrical shock, do not come in contact with the primary AC circuitry on the Power Supply mounted on the rear of the case.

Notes: Reference all measurements to TP1-1 (G) on the Power Management Board unless otherwise noted.

To improve common mode rejection when checking ripple voltages, disconnect the DMM from the test points, isolate oscilloscope ground from the AC line, and connect the oscilloscope ground probe to TP1-1 (G). Do not use a oscilloscope ground probe which exceeds 8".

The microprocessor based system generates high amplitude (up to 200 mV P-P) short duration (less than 2 microsecond) pulses at various repetition rates. These pulses are to be ignored when performing ripple voltage measurements.

ESD Suppressor Check

6.5.1 ESD SUPPRESSOR CHECK

1. Unplug the unit from AC power.
2. Connect the negative output of the 24.0 +/- 1.0 VDC power supply through a 1 K ohm resistor to TP1-1 (G) on the Power Management Board.

   Caution: Do not connect the power supply directly to TP1-1 (G) without the resistor.

3. Connect the positive output of the power supply to one of the pump module motor plates.
4. Connect the DMM to the motor plate.
5. Verify that voltage is between 16.0 and 21.0 VDC.
6. Disconnect the DMM and the power supply.

12 VDC Power Supply

6.5.2 12 VDC POWER SUPPLY

1. Disconnect the pump from AC power and remove the battery fuse.
2. Remove the Power Management Board and place it on the extender board.
3. Reinstall the battery fuse and connect unit to AC power.
4. Turn on all channels.
5. Connect the DMM to TPA-4 (+12V) on the Power Management Extender Board.
6. Verify that the voltage is between 11.75 and 12.25 VDC.
7. Disconnect the DMM.
8. Connect the oscilloscope to TPA-4 (+12V) on the Power Management Extender Board.
9. Verify a ripple voltage of less than 120 mV P-P.
10. Disconnect the oscilloscope, remove AC power, and remove the battery fuse.
11. Remove the extender board and reinstall the Power Management Board.

Battery Voltage

6.5.3 BATTERY VOLTAGE

1. Reinstall the battery fuse.
2. With the AC power cord unplugged, turn on one channel only.
3. Connect the DMM to TP1-16 (B+) on the Power Management Board and verify that the voltage is between 8.00 and 9.50 VDC.
4. Disconnect the DMM.

Reassembly:

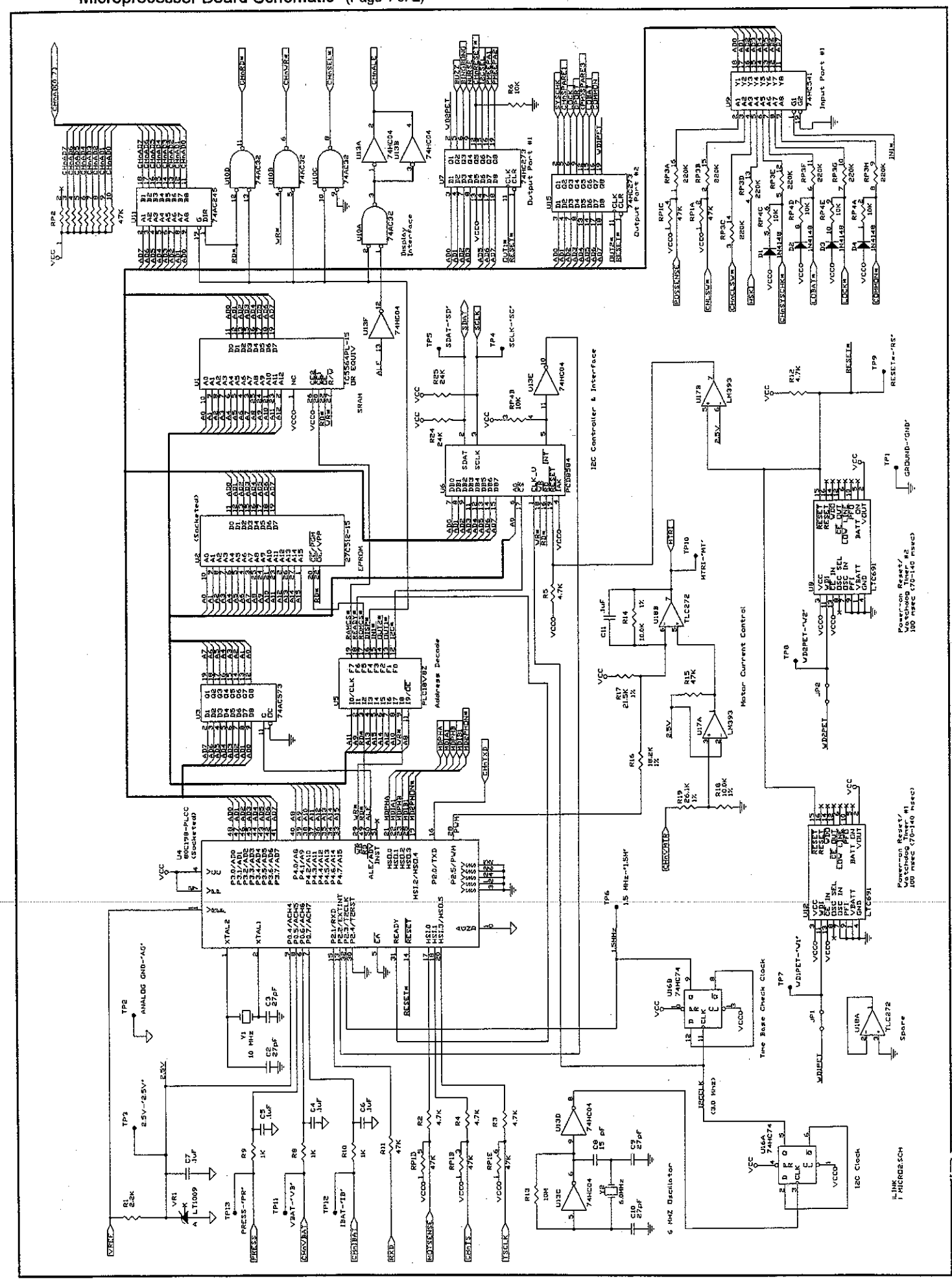
1. Unplug unit from AC power and remove battery fuse.
2. Close the case per Section 5.0.

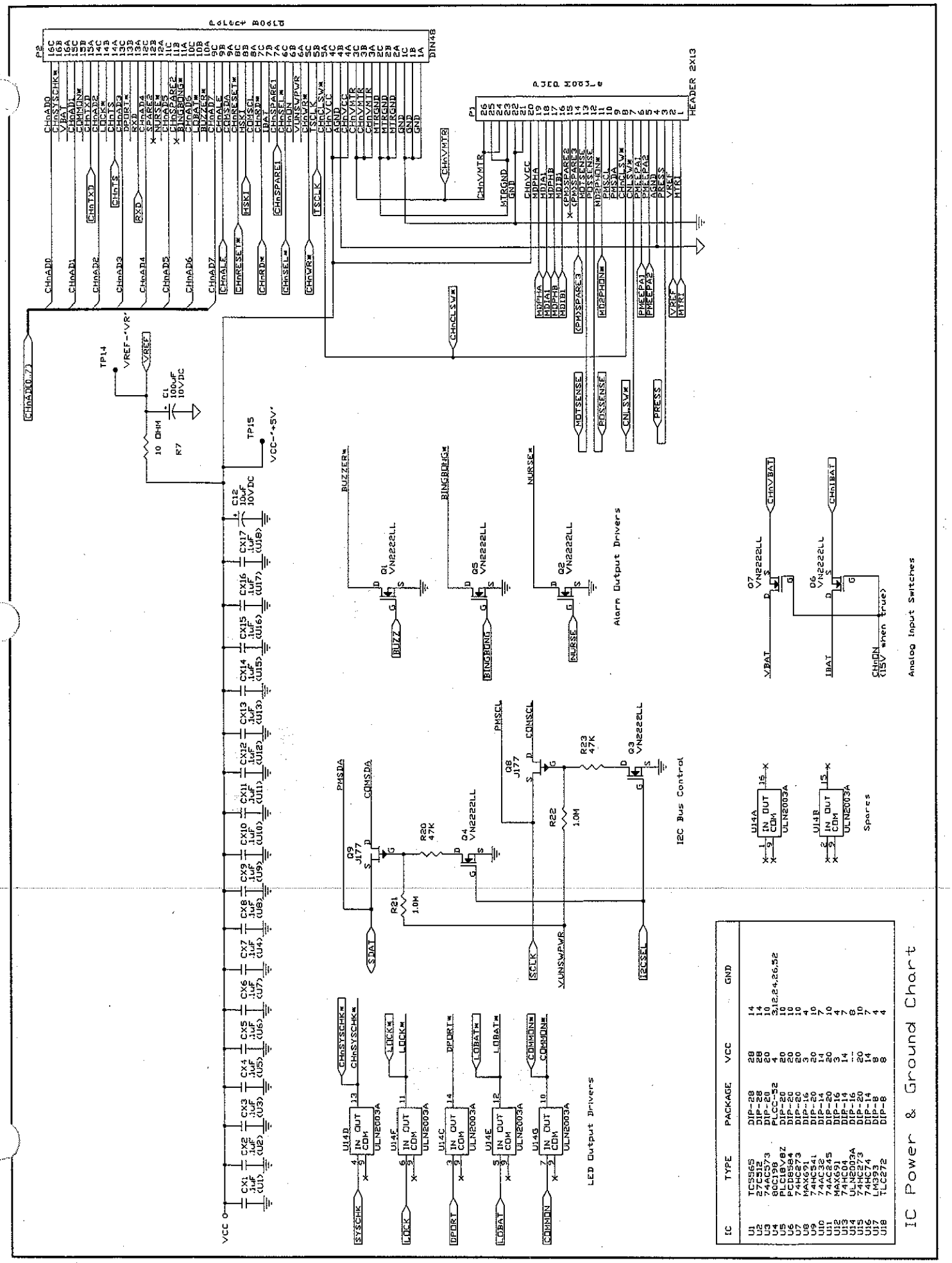
Note: Prior to placing the pump into clinical use, the following procedure must be performed:

- Periodic Maintenance Procedure, section 3.1.

Section 7.0
Schematics and Assembly Diagrams

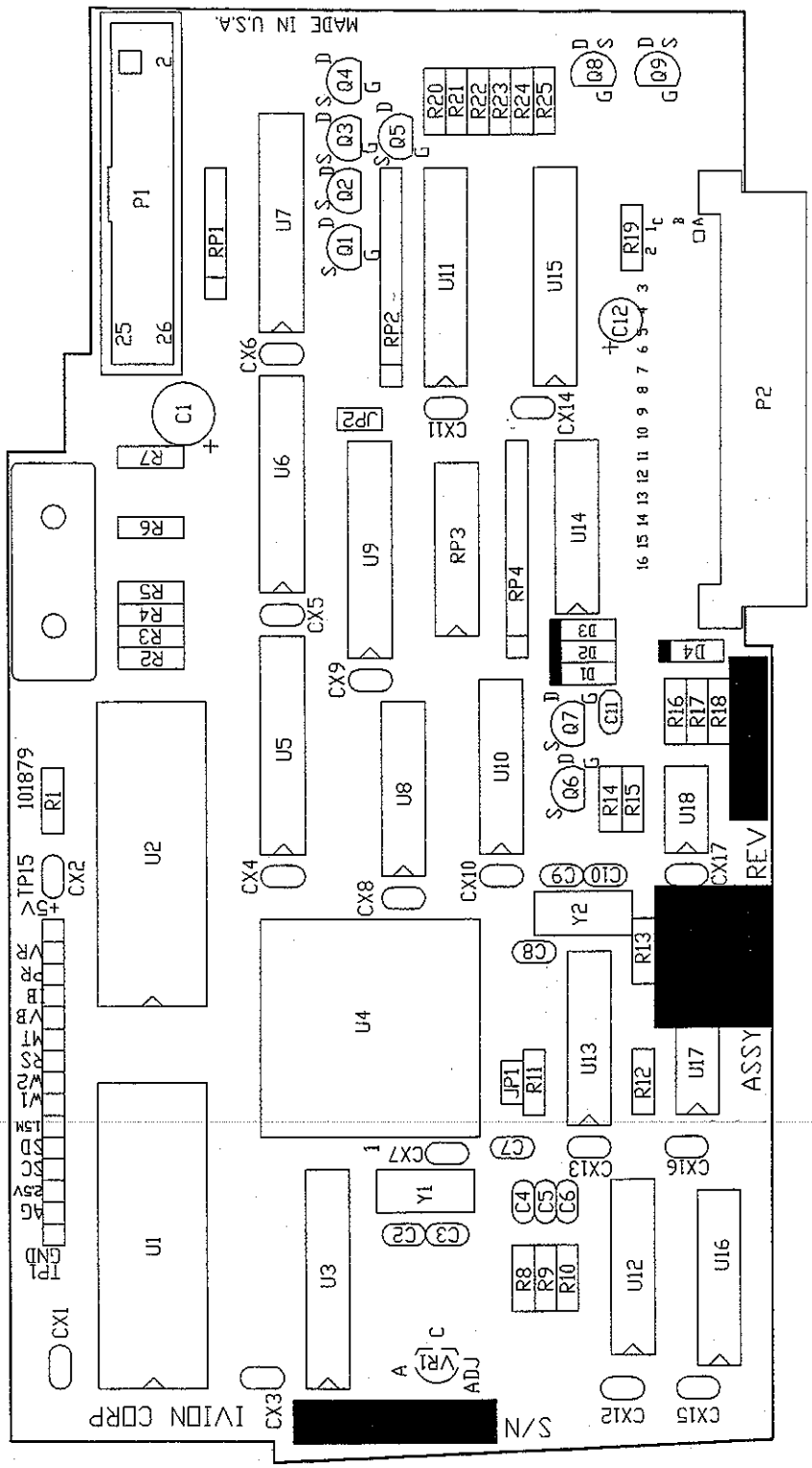
This section contains illustrations of the Trilogy schematics and assembly diagrams.



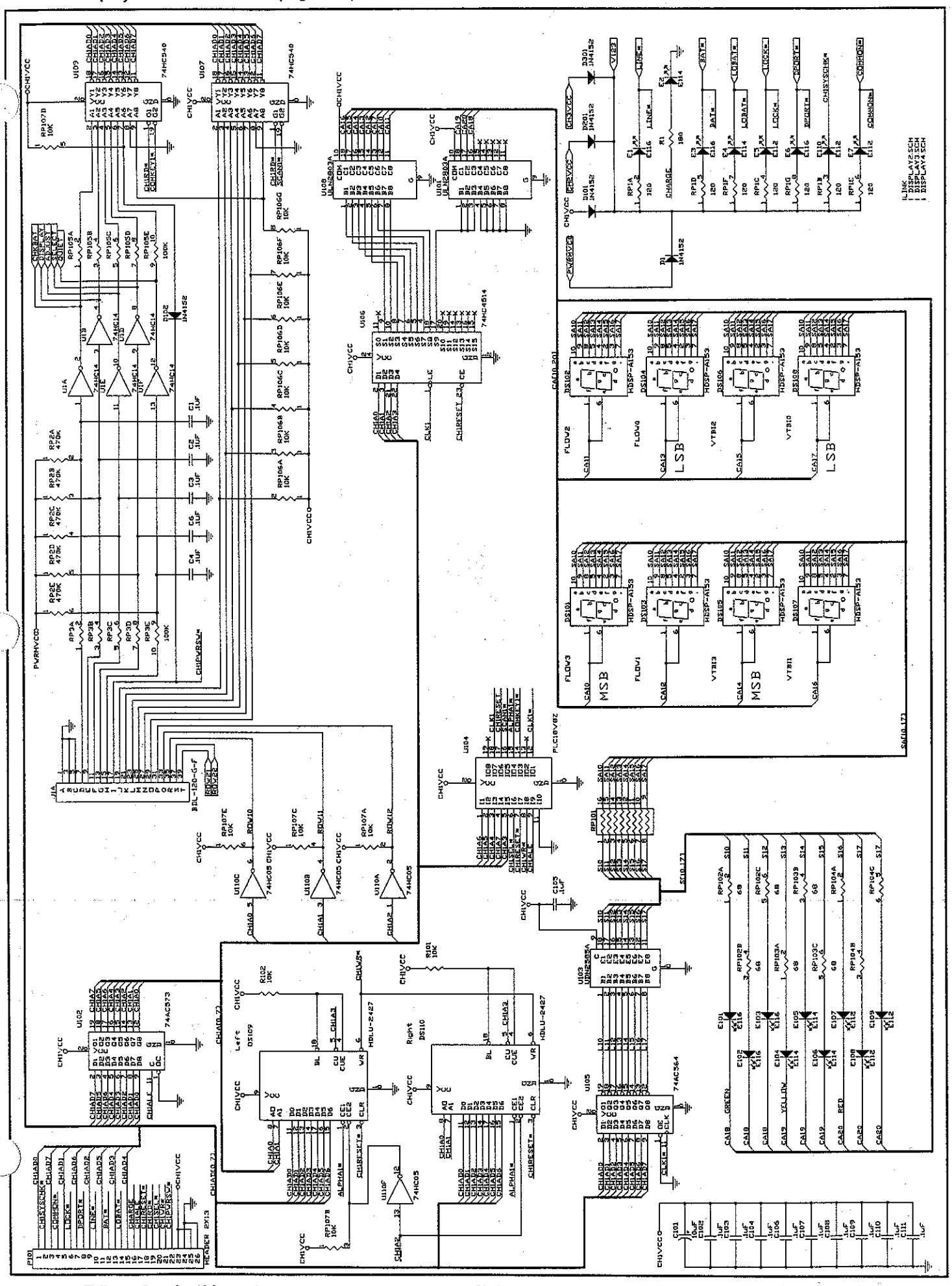


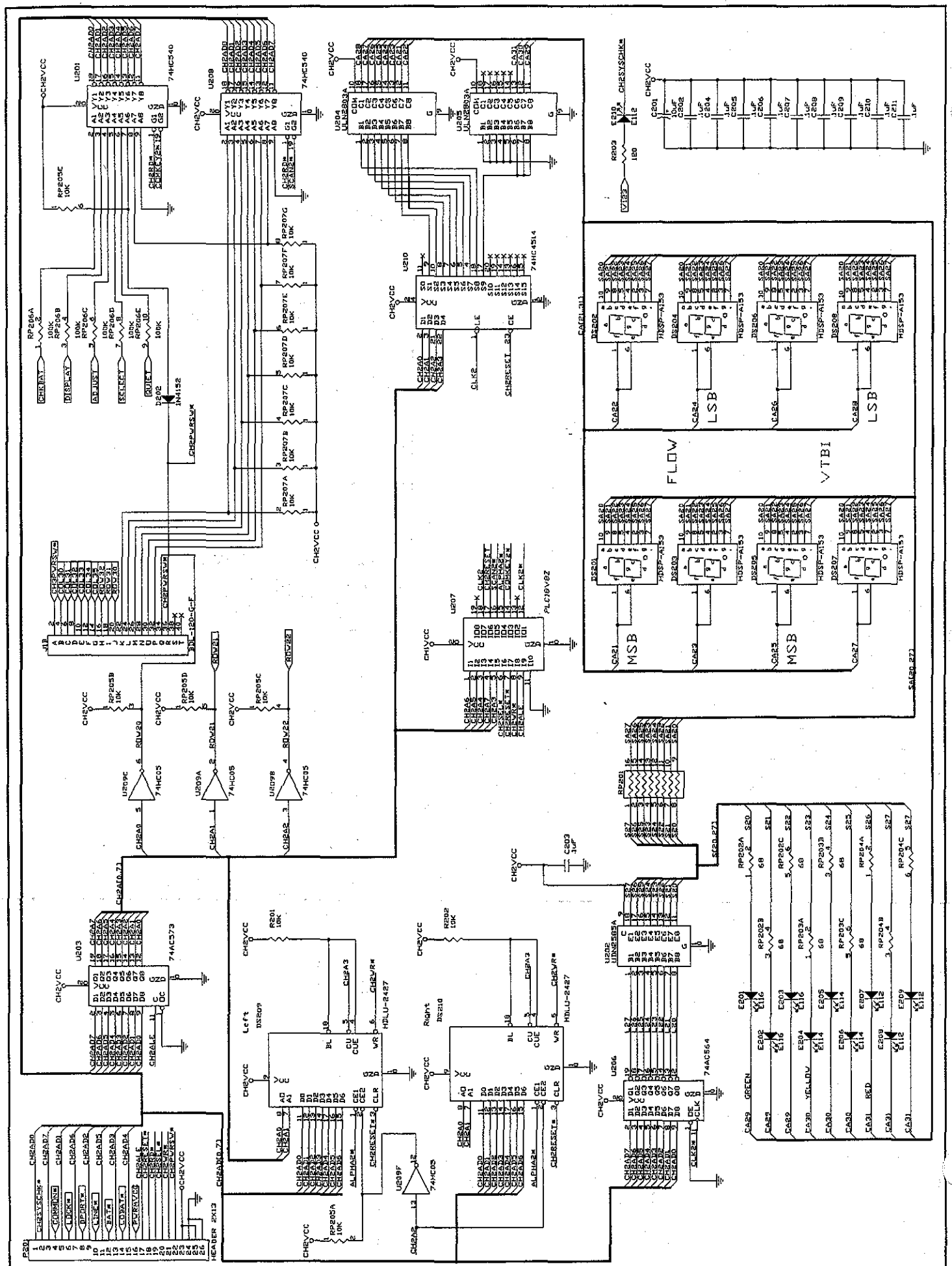
IC Power & Ground Chart

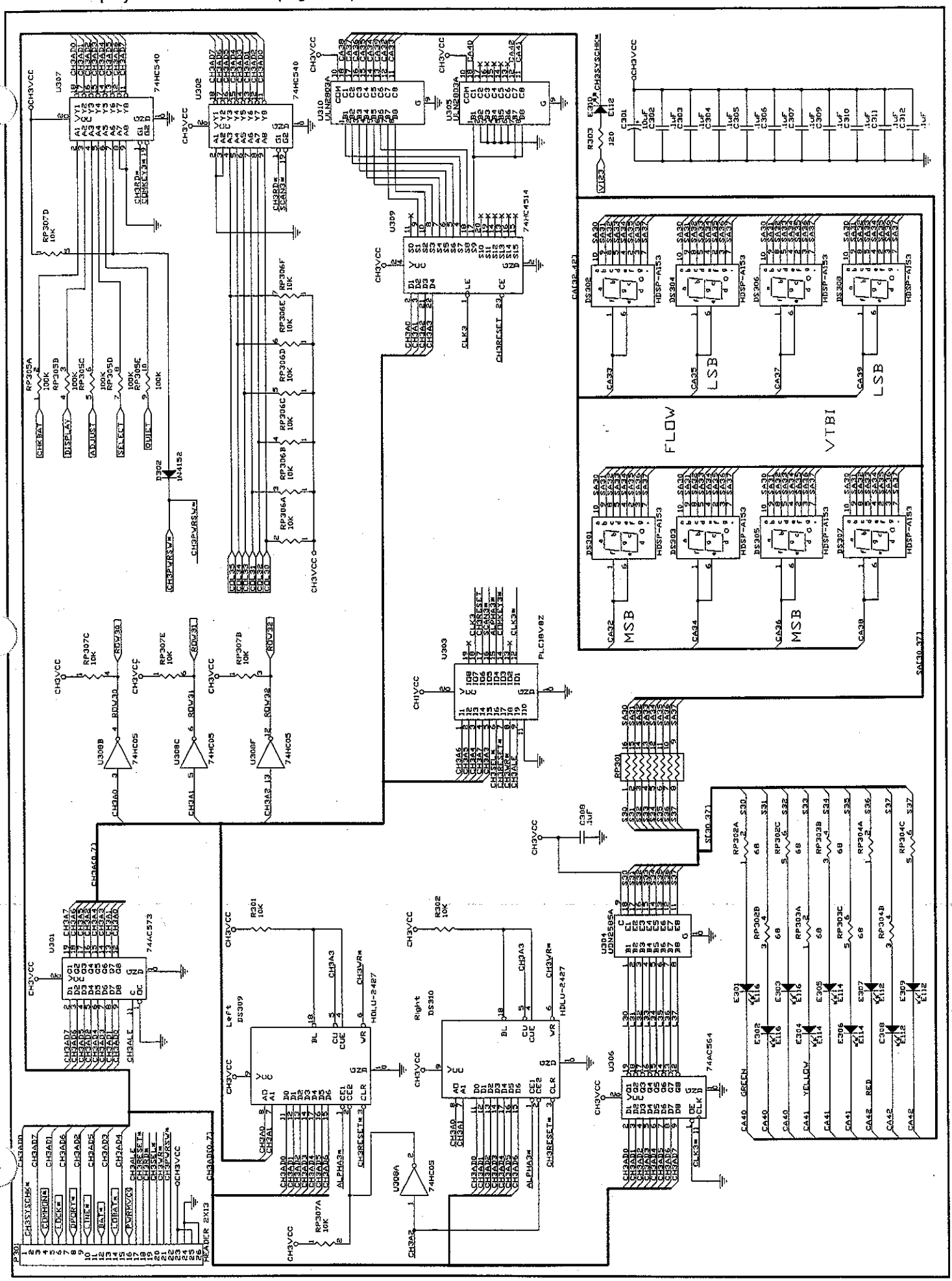
IC	TYPE	PACKAGE	VCC	GND
U1	TC5565	DIP-28	28	14
U2	27C512	DIP-28	28	14
U3	74AC573	DIP-20	20	10
U4	80C188	PLCC-52	41	1,2,26,52
U5	PCD8584	DIP-20	20	10
U6	74HC273	DIP-20	20	10
U7	MAX691	DIP-16	3	4
U8	74HC541	DIP-20	20	10
U9	74AC32	DIP-14	14	7
U10	74AC245	DIP-20	20	10
U11	MAX691	DIP-16	3	4
U12	74HC04	DIP-14	14	7
U13	ULN2003A	DIP-16	--	8
U14	74HC273	DIP-20	20	10
U15	74HC74	DIP-14	14	7
U16	LM393	DIP-8	8	4
U17	TLC272	DIP-8	8	4
U18				


MADE IN U.S.A.
P1
P2
RP1
RP2
RP3
RP4
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U11
U12
U13
U14
U15
U16
U17
U18
Y1
Y2
C1
CX1
CX2
CX3
CX4
CX5
CX6
CX7
CX8
CX9
CX10
CX11
CX12
CX13
CX14
CX15
CX16
CX17
JP1
JP2
VR1
ADJ
TP15
GND
101879
REV
ASSY
S/N
IVIDN CORP

Display Board Schematic (Page 1 of 4)

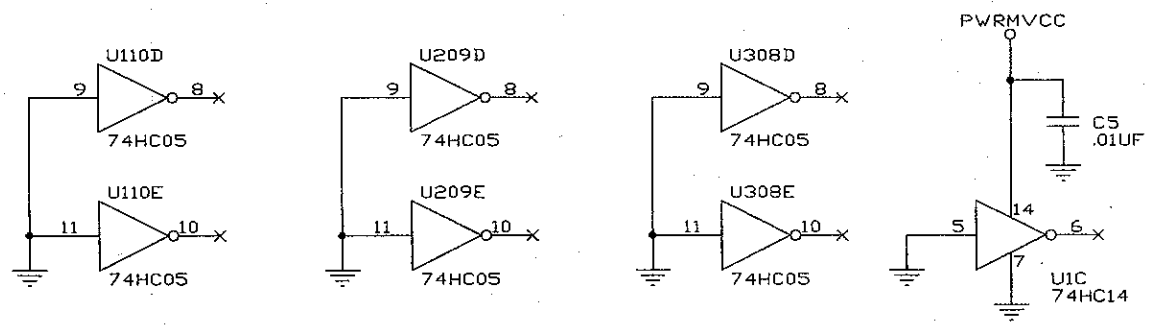



FLOW
VTBI
MSB
LSB
MSB
LSB
Left
Right
GREEN
YELLOW
RED
HEADER 2X13


FLOW
VTBI
MSB
LSB
MSB
LSB
Left
Right
GREEN
YEL-GRN
RED
CH3SYSCHK*
CH3WRN*
CLOCK*
CH3PORT*
CH3WE*
CH3RD*
CH3BAT*
CH3PWRSW*
CH3PWRVCC
READER 2X13

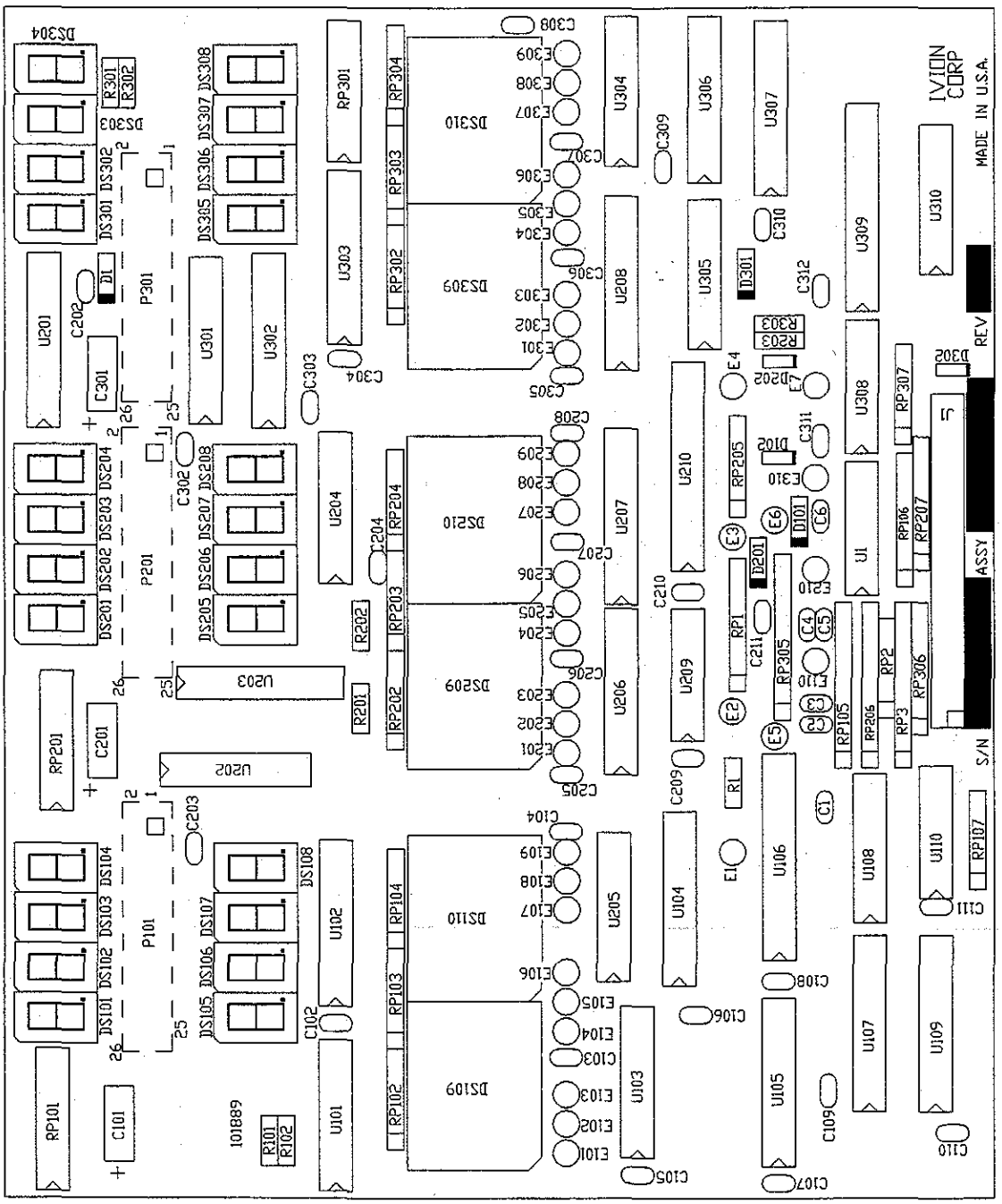
IC	TYPE	PACKAGE	CH1VCC	CH2VCC	CH3VCC	GND	PWRMVCC
U1	74HC14	DIP-14	--	--	--	7	14
U101	ULN2803A	DIP-18	--	--	--	9	--
U102	74AC573	DIP-20	20	--	--	10	--
U103	UDN2585A	DIP-18	9	--	--	10	--
U104	PLC18V8Z	DIP-20	20	--	--	10	--
U105	74AC564	DIP-20	20	--	--	10	--
U106	74HC4514	SDIP-24	24	--	--	12	--
U107	74HC540	DIP-20	20	--	--	10	--
U108	ULN2803A	DIP-18	--	--	--	9	--
U109	74HC540	DIP-20	20	--	--	10	--
DS109	HDLU-2427	WDIP-18	9	--	--	10	--
DS110	HDLU-2427	WDIP-18	9	--	--	10	--
U110	74HC05	DIP-14	14	--	--	7	--
U201	74HC540	DIP-20	--	20	--	10	--
U202	UDN2585A	DIP-18	--	9	--	10	--
U203	74AC573	DIP-20	--	20	--	10	--
U204	ULN2803A	DIP-18	--	--	--	9	--
U205	ULN2803A	DIP-18	--	--	--	9	--
U206	74AC564	DIP-20	--	20	--	10	--
U207	PLC18V8Z	DIP-20	--	20	--	10	--
U208	74HC540	DIP-20	--	20	--	10	--
U209	74HC05	DIP-14	--	14	--	7	--
U210	74HC4514	SDIP-24	--	24	--	12	--
DS209	HDLU-2427	WDIP-18	--	9	--	10	--
DS210	HDLU-2427	WDIP-18	--	9	--	10	--
U301	74AC573	DIP-20	--	--	20	10	--
U302	74HC540	DIP-20	--	--	20	10	--
U303	PLC18V8Z	DIP-20	--	--	20	10	--
U304	UDN2585A	DIP-18	--	--	9	10	--
U305	ULN2803A	DIP-18	--	--	--	9	--
U306	74AC564	DIP-20	--	--	20	10	--
U307	74HC540	DIP-20	--	--	20	10	--
U308	74HC05	DIP-14	--	--	14	7	--
U309	74HC4514	SDIP-24	--	--	24	12	--
U310	ULN2803A	DIP-18	--	--	--	9	--
DS309	HDLU-2427	WDIP-18	--	--	9	10	--
DS310	HDLU-2427	WDIP-18	--	--	9	10	--

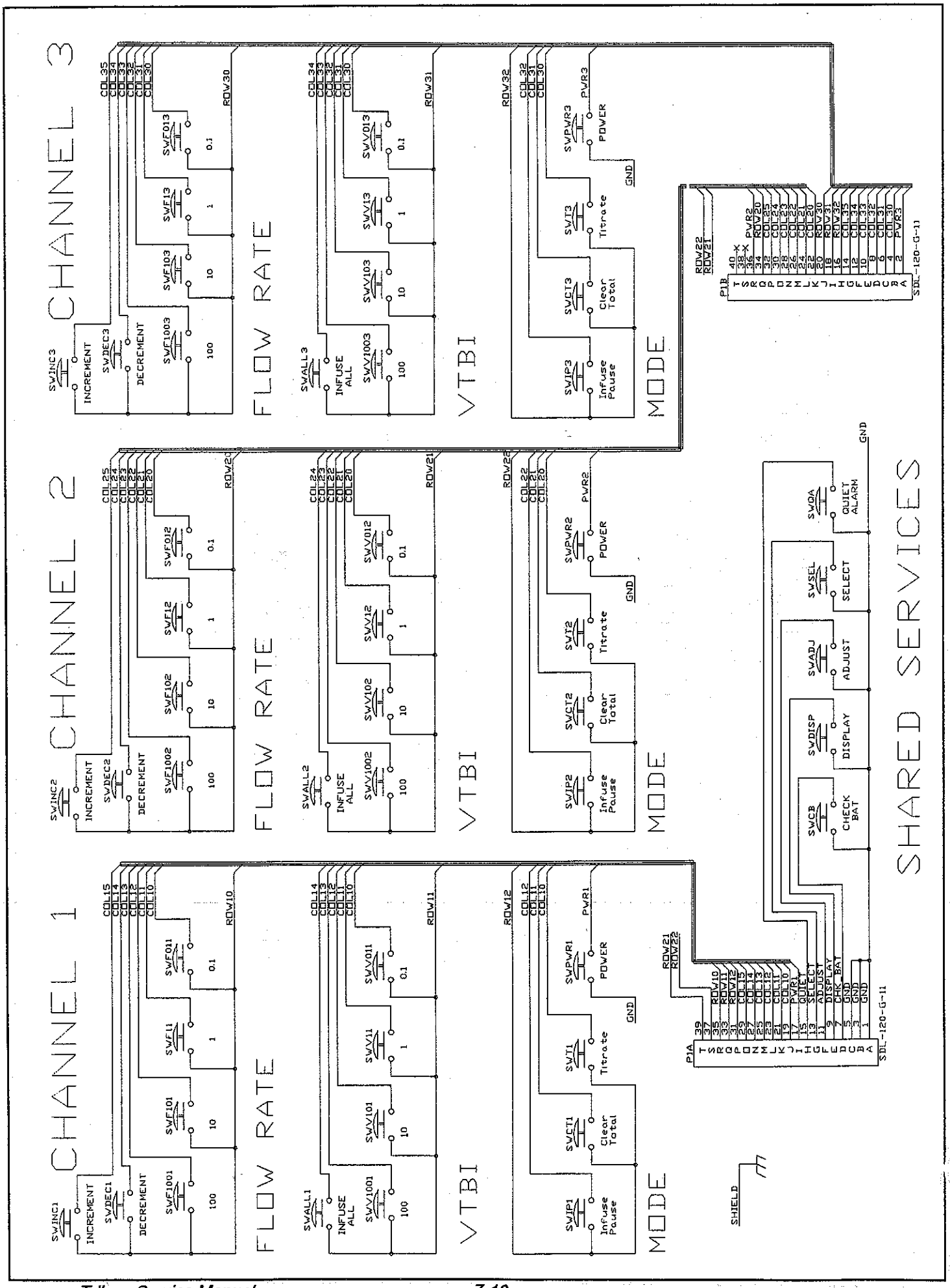
IC & Display Power & Ground Chart



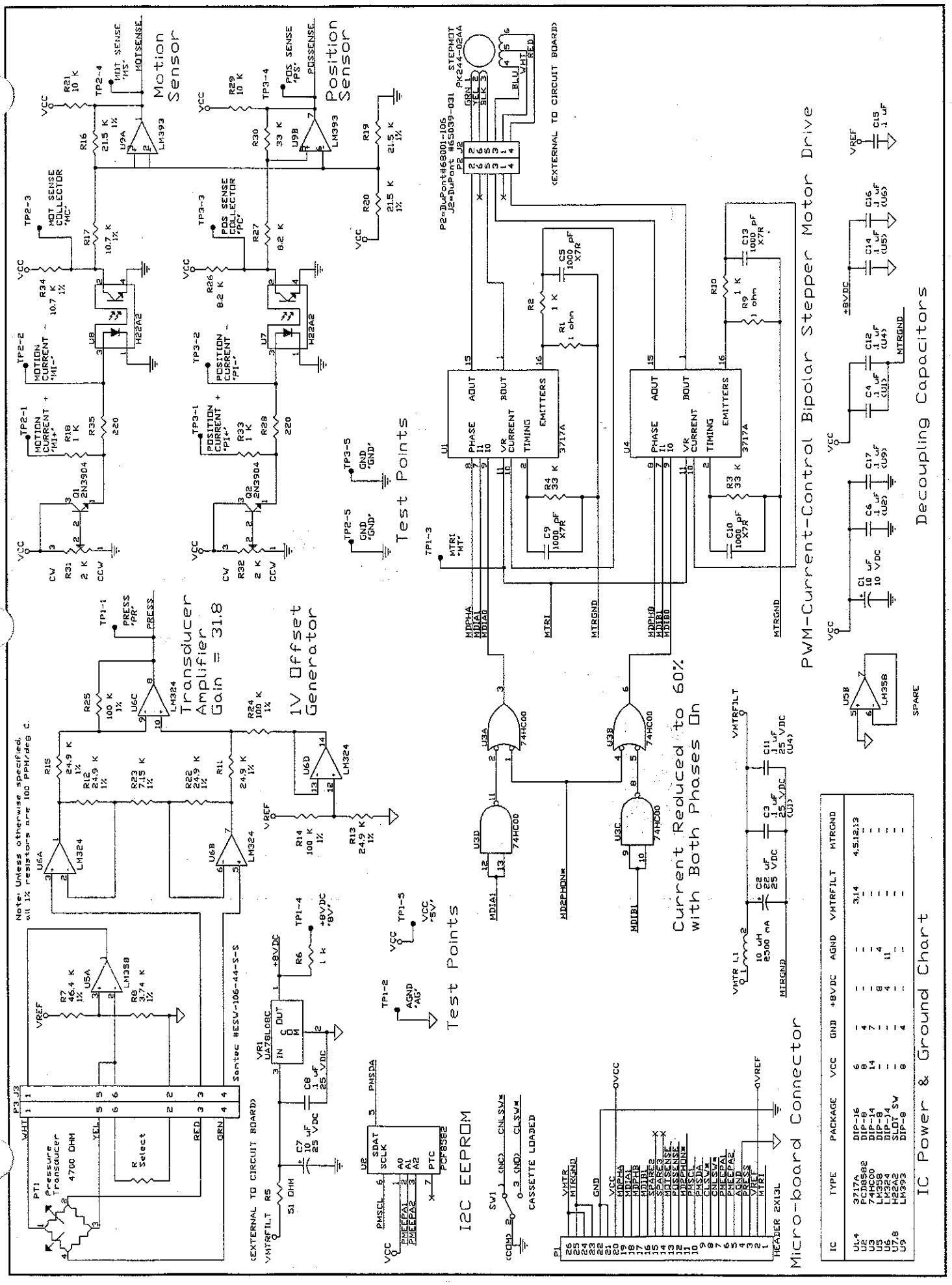
Spare Gates

Display Board

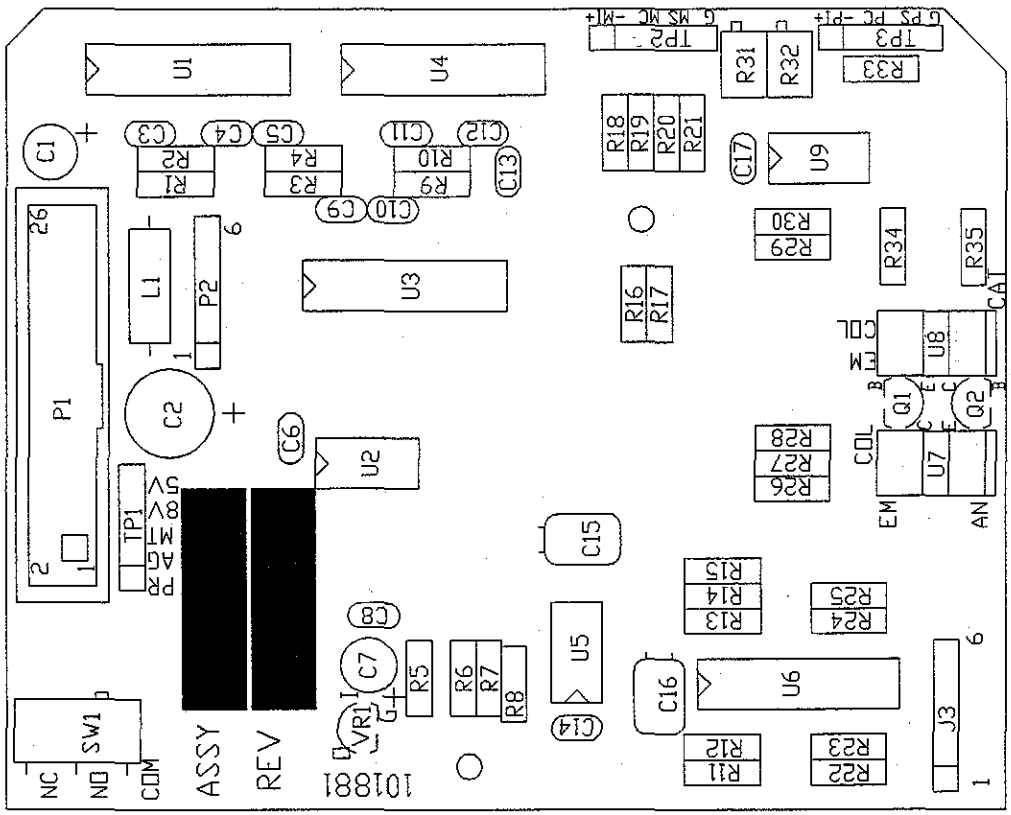


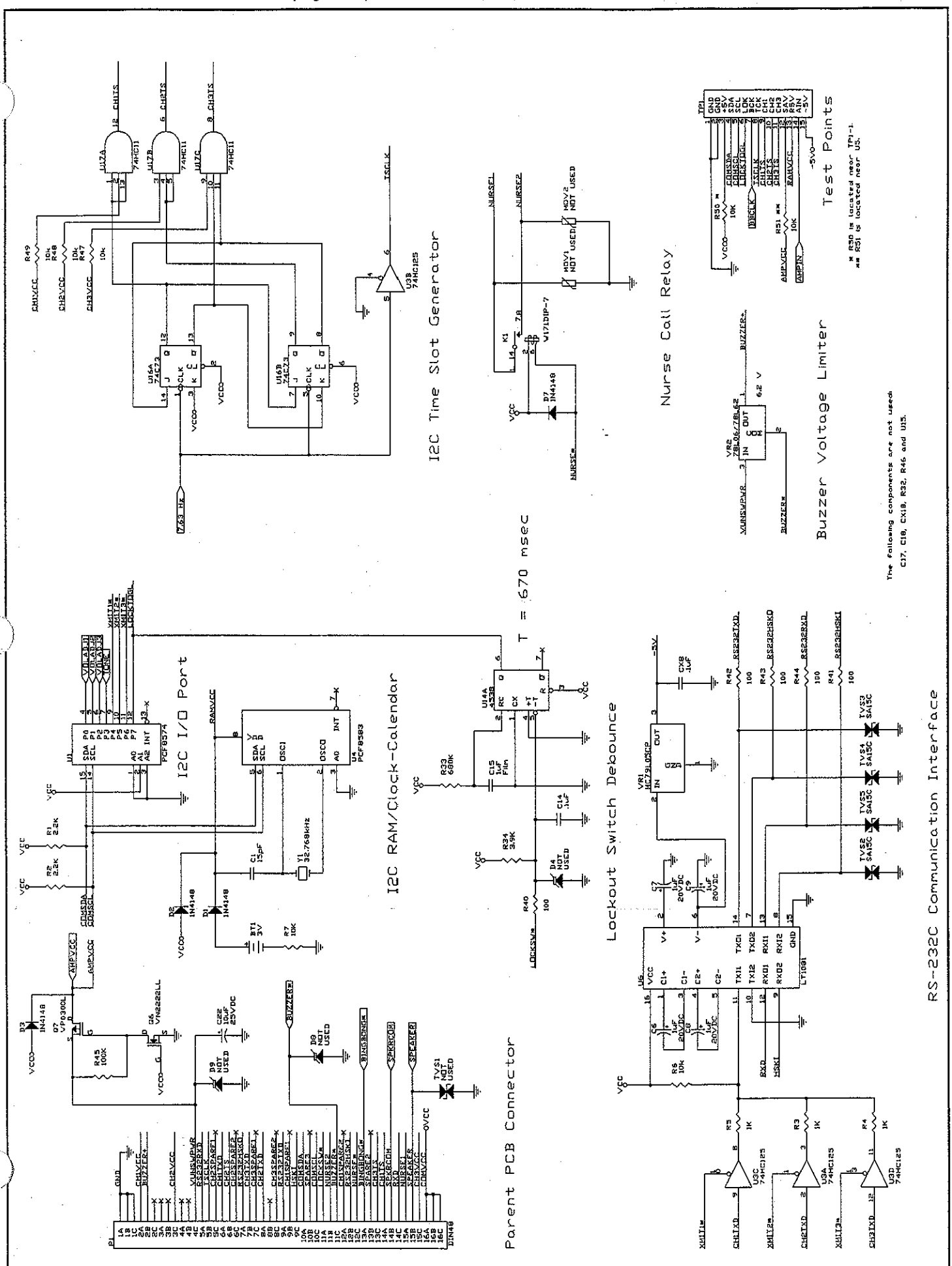

CHANNEL 1
CHANNEL 2
CHANNEL 3
SHARED SERVICES
FLOW RATE
VTBI
MODE
INCREMENT
DECREMENT
INFUSE ALL
Infuse Pause
Clear Total
Titrate
POWER
CHECK BAT
DISPLAY
ADJUST
SELECT
QUIET ALARM
SHIELD
GND
SDL-120-G-11

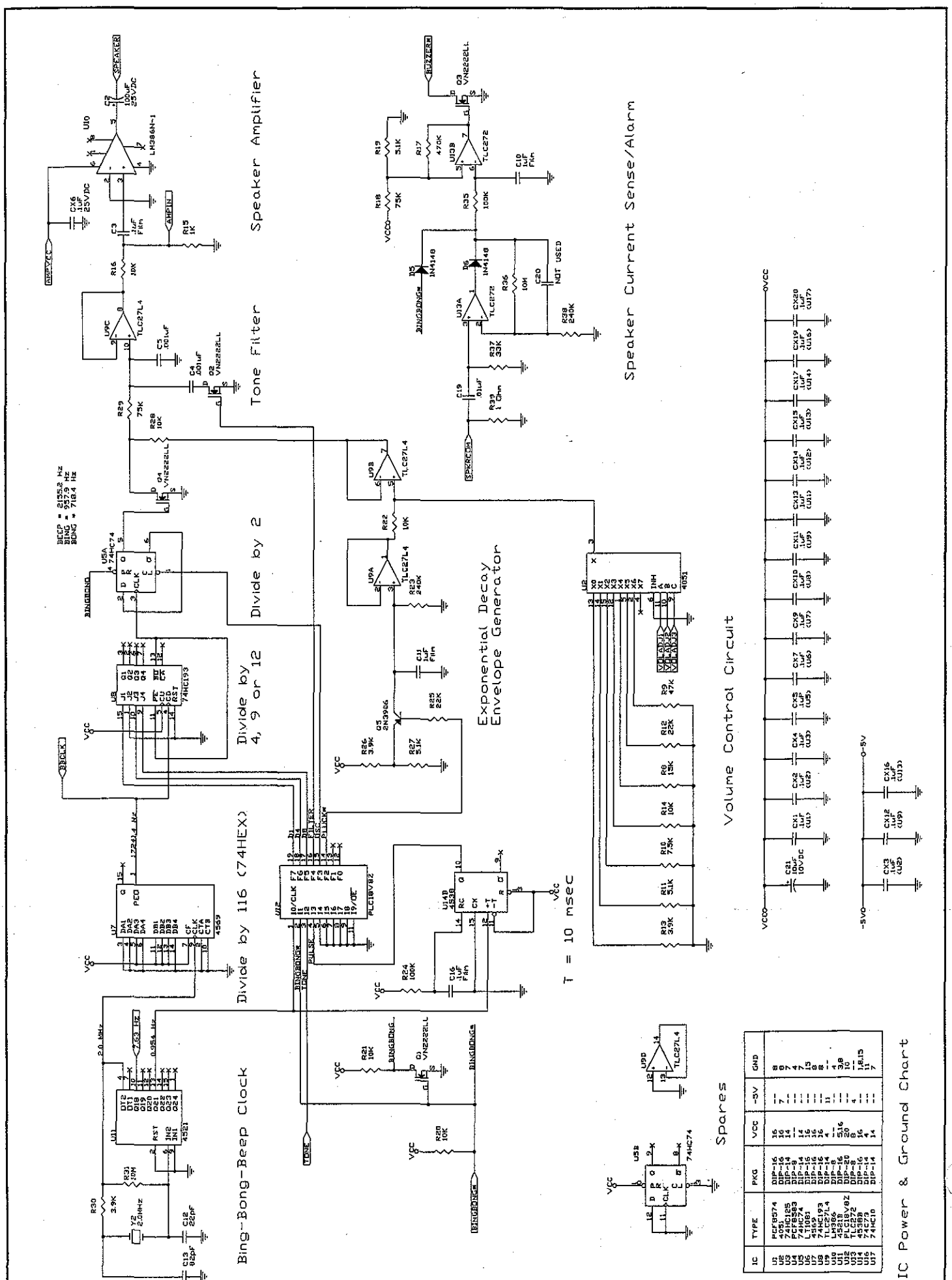
Pump Module Interface Board Schematic



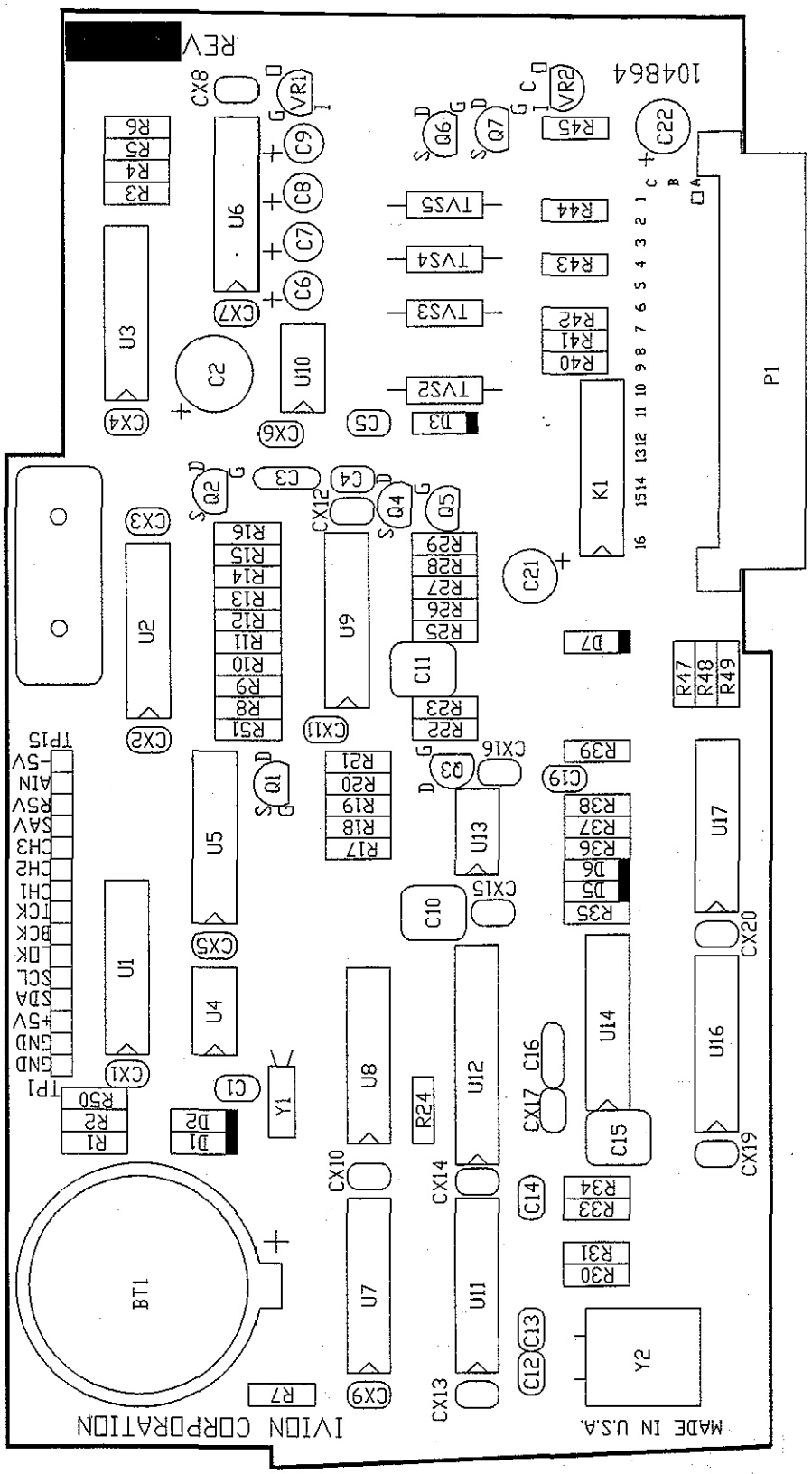
IC	TYPE	PACKAGE	VCC	GND	+8VDC	AGND	VMTRFILT	MTRGND
U1,4	3717A	DIP-16	6	-	-	-	3,14	4,5,12,13
U2	PCD8582	DIP-8	8	4	-	-	-	-
U3	74HC00	DIP-14	14	7	-	-	-	-
U5	LM358	DIP-8	-	-	8	4	-	-
U6,7,8	H22A2	SLOT SW	-	-	4	11	-	-
U9	LM393	DIP-8	8	4	-	-	-	-

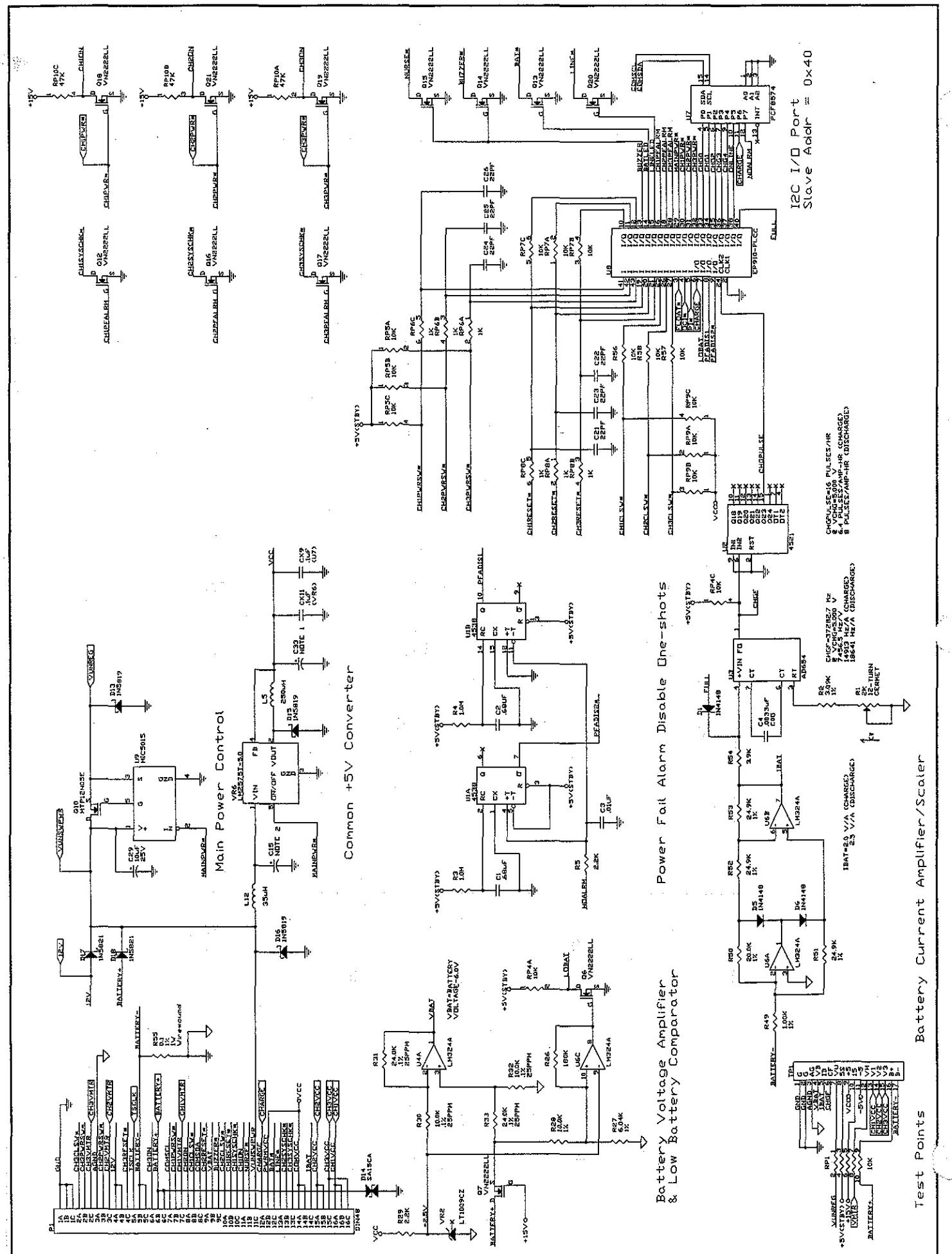

U1
U4
TP2
TP3
R31
R32
R33
C1
C3
C4
C5
C11
C12
R18
R19
R20
R21
C17
U9
R2
R1
R4
R3
R9
R10
C13
C9
C10
R30
R29
R34
R35
L1
P2
U3
R16
R17
CAT
COL
EM
U8
Q1
Q2
C2
C6
U2
R28
R27
R26
TP1
5V
BV
MTG
PR
P1
C15
R15
R14
R13
R25
R24
C8
C7
R5
R6
R7
R8
U5
C14
VR1
C16
U6
R12
R11
R23
R22
J3
SW1
NC
NO
COM
ASSY
REV
101881

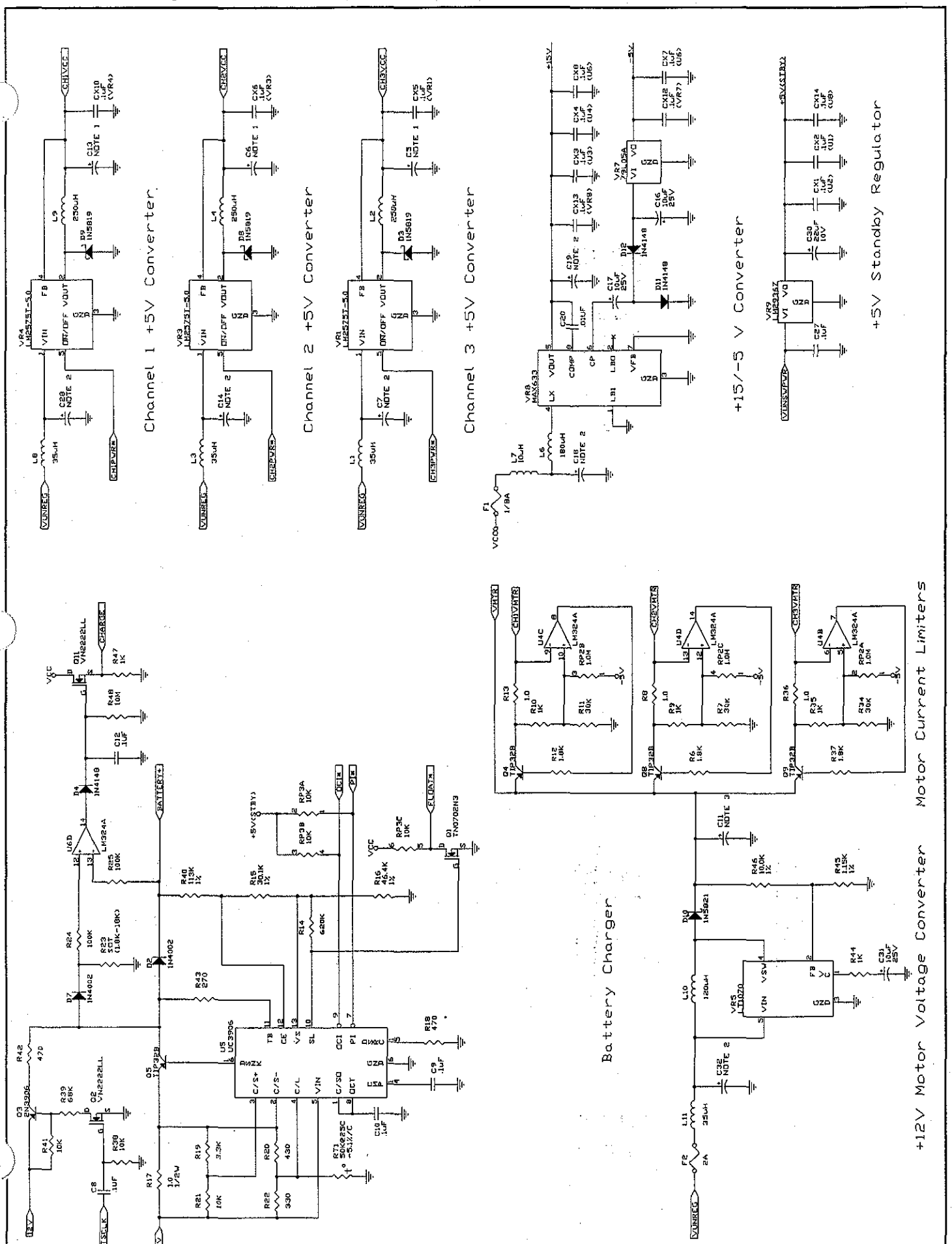

I2C Time Slot Generator
Nurse Call Relay
Test Points
Buzzer Voltage Limiter
I2C I/O Port
I2C RAM/Clock-Calendar
T = 670 msec
Lockout Switch Debounce
RS-232C Communication Interface
Parent PCB Connector
The following components are not used:
C17, C18, CX18, R32, R46 and U15.



IC	TYPE	PKG	VCC	-5V	GND
U3	PCF8574	DIP-16	16	8	8
U4	4013	DIP-14	14	7	7
U5	74HC125	DIP-14	14	7	7
U6	PCF8583	DIP-8	8	---	4
U7	4069	DIP-14	14	---	7
U8	74HC193	DIP-16	16	---	8
U9	TLC27L4	DIP-14	4	---	11
U10	LM386	DIP-8	4	---	4
U11	4521B	DIP-16	5V	---	3,8
U12	TLC372	DIP-8	20	---	10
U13	TLC272	DIP-20	20	---	1,8,15
U14	4538B	DIP-16	16	---	11
U15	74C73	DIP-14	4	---	7
U17	74HC10	DIP-14	14	---	7


REV
104864
IVION CORPORATION
MADE IN U.S.A.
P1
K1
U1
U2
U3
U4
U5
U6
U7
U8
U9
U10
U11
U12
U13
U14
U16
U17
BT1
Y1
Y2
TP15
TP1
5V
AIN
RSV
SAV
CH3
CH2
CH1
TCK
BCK
DK
SCL
SDA
+5V
GND
GND


I2C I/O Port
Slave Addr = 0x40
Main Power Control
Common +5V Converter
Power Fail Alarm Disable One-shots
Battery Voltage Amplifier
& Low Battery Comparator
Test Points
Battery Current Amplifier/Scaler


Channel 1 +5V Converter
Channel 2 +5V Converter
Channel 3 +5V Converter
+15/-5 V Converter
+5V Standby Regulator
Battery Charger
+12V Motor Voltage Converter
Motor Current Limiters

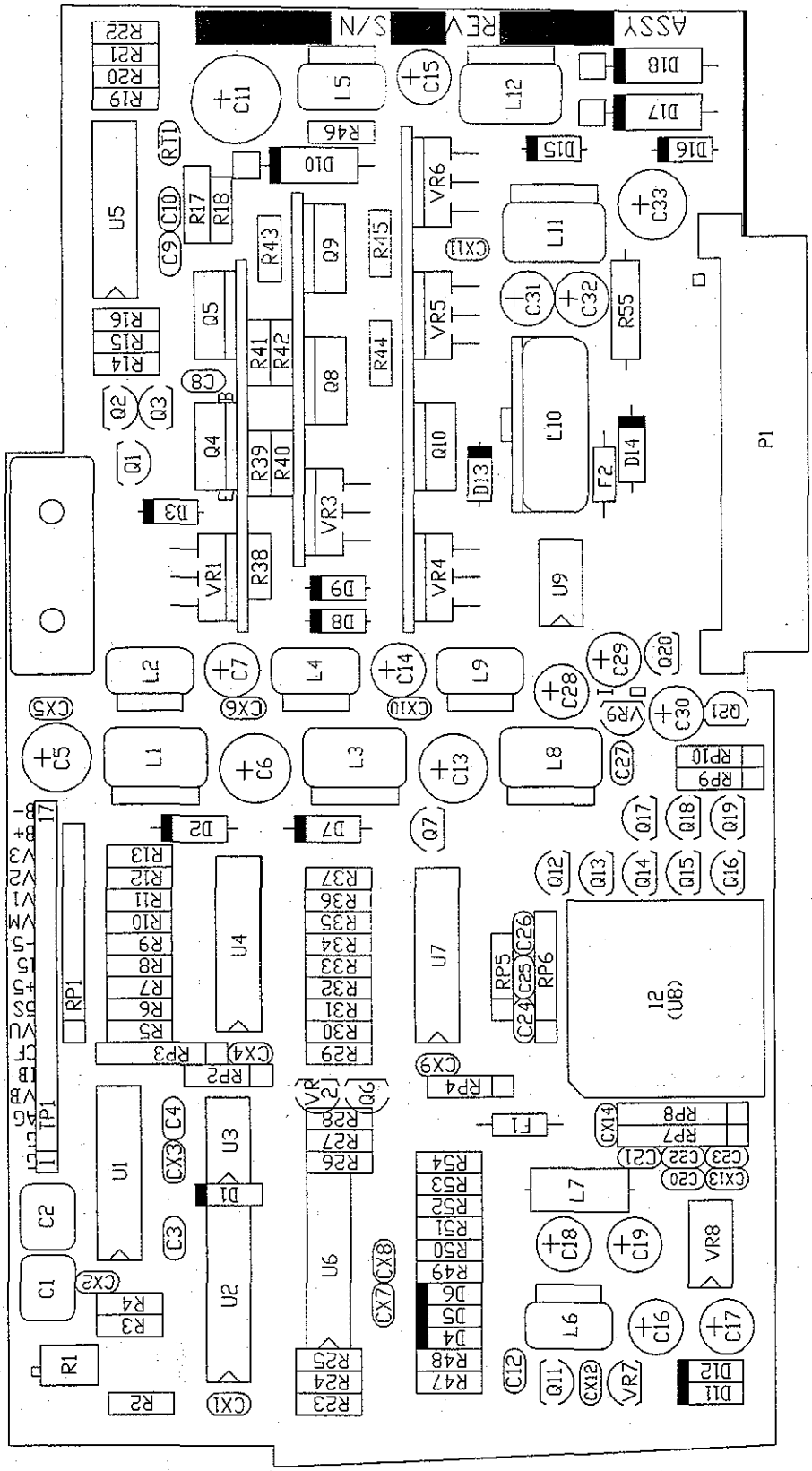
IC	TYPE	PKG	VCC	+5V(STBY)	+15V	-5V	GND
U1	4538B	DIP-16	--	16	--	--	8
U2	4521B	DIP-16	--	5,16	--	--	3,8
U3	AD654	DIP-8	--	--	8	--	2,5
U4	LM324A	DIP-14	--	--	4	--	11
U5	UC3906	DIP-16	--	--	--	--	6
U6	LM324A	DIP-14	--	--	4	11	--
U7	PCF8574	DIP-16	16	--	--	--	8
U8	EP910	PLCC-44	--	1,44	--	--	22,23
U9	MIC5015	DIP-8	--	--	--	--	4

IC Power & Ground Chart

Last Reference Designators Used			
C33	CX14	D18	F2
L12	P1	Q21	R55
RP10	RT1	U9	VR9

Notes:

1. Aluminum electrolytic, 100 uF minimum, 10 WVDC, ESR <0.1 ohm @ 100 kHz, ripple current rating >0.1 amp RMS.
2. Aluminum electrolytic, 100-150 uF nominal, 25 WVDC, ESR <0.3 ohm @ 100 kHz, ripple current rating >0.2 amp RMS.
3. Aluminum electrolytic, 100 uF minimum, 25 WVDC, ESR <0.1 ohm @ 100 kHz, ripple current rating >0.7 amp RMS.


ASSY
REV
S/N
P1
U1
U2
U3
U4
U5
U6
U7
U8
U9
L1
L2
L3
L4
L5
L6
L7
L8
L9
L10
L11
L12
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20
C21
C22
C23
C24
C25
C26
C27
C28
C29
C30
C31
C32
C33
D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
D13
D14
D15
D16
D17
D18
Q1
Q2
Q3
Q4
Q5
Q6
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
Q16
Q17
Q18
Q19
Q20
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22
R23
R24
R25
R26
R27
R28
R29
R30
R31
R32
R33
R34
R35
R36
R37
R38
R39
R40
R41
R42
R43
R44
R45
R46
R47
R48
R49
R50
R51
R52
R53
R54
R55
VR1
VR2
VR3
VR4
VR5
VR6
VR7
VR8
RP1
RP2
RP3
RP4
RP5
RP6
RP7
RP8
RP9
RP10
F1
F2
TP1
CX1
CX2
CX3
CX4
CX5
CX6
CX7
CX8
CX9
CX10
CX11
CX12
CX13
CX14
RT1

Line	Signal Name	J1 Micro 3	J2 Power Management	J3 Micro 2	J4 Common	J5 Micro 1	J6 Display 3	J7 Display 2	J8 Display 1	J9 Rear Panel	J10 Pwr Supply /Battery	See Note
1	12V	-	4A,4B	-	-	-	-	-	-	-	1,2	
2	12VCOM	-	-	-	-	-	-	-	-	-	3,4	
3	AGND	4B	3A	4B	-	4B	-	-	-	-	-	
4	BAT*	-	12C	-	-	-	12	12	12	-	-	
5	BATTERY+	-	6B,6C	-	-	-	-	-	-	-	5,6	
6	BATTERY-	-	5B,5C	-	-	-	-	-	-	-	7,8	
7	BINGBONG*	11A	-	11A	13A	11A	-	-	-	-	-	
8	BUZZER*	10A	9C	10A	11C	10A	-	-	-	9	-	
9	BUZZER+	-	-	-	2B	-	-	-	-	1	-	
10	CH1AD0	-	-	-	-	16C	-	-	1	-	-	
11	CH1AD1	-	-	-	-	15C	-	-	5	-	-	
12	CH1AD2	-	-	-	-	14C	-	-	9	-	-	
13	CH1AD3	-	-	-	-	13C	-	-	13	-	-	
14	CH1AD4	-	-	-	-	12C	-	-	15	-	-	
15	CH1AD5	-	-	-	-	11C	-	-	11	-	-	
16	CH1AD6	-	-	-	-	10C	-	-	7	-	-	
17	CH1AD7	-	-	-	-	9C	-	-	3	-	-	
18	CH1ALE	-	-	-	-	9B	-	-	17	-	-	
19	CH1CLSW*	-	8B	-	-	5A	-	-	-	-	-	
20	CH1ON	-	11A	-	-	6B	-	-	-	-	-	
21	CH1PWRSW*	-	7B	-	-	-	-	-	22	-	-	
22	CH1RD*	-	-	-	-	7C	-	-	19	-	-	
23	CH1RESET*	-	10B	-	-	8C	-	-	18	-	-	
24	CH1SEL*	-	-	-	-	6C	-	-	20	-	-	
25	CH1SPARE1	-	-	-	9B	7A	-	-	-	-	-	
26	CH1SPARE2	-	-	-	12A	11B	-	-	-	-	-	
27	CH1SYSCHK*	-	10C	-	-	16B	-	-	2	-	-	
28	CH1TS	-	-	-	14A	14A	-	-	-	-	-	
29	CH1TXD	-	-	-	6A	15A	-	-	-	-	-	
30	CH1VCC	-	16A,16B	-	2A	4A,4C	-	-	23,25	-	-	
31	CH1VMTR	-	7C	-	-	3A,3B,3C	-	-	-	-	-	
32	CH1WR*	-	-	-	-	5C	-	-	21	-	-	
33	CH2AD0	-	-	16C	-	-	-	1	-	-	-	
34	CH2AD1	-	-	15C	-	-	-	5	-	-	-	

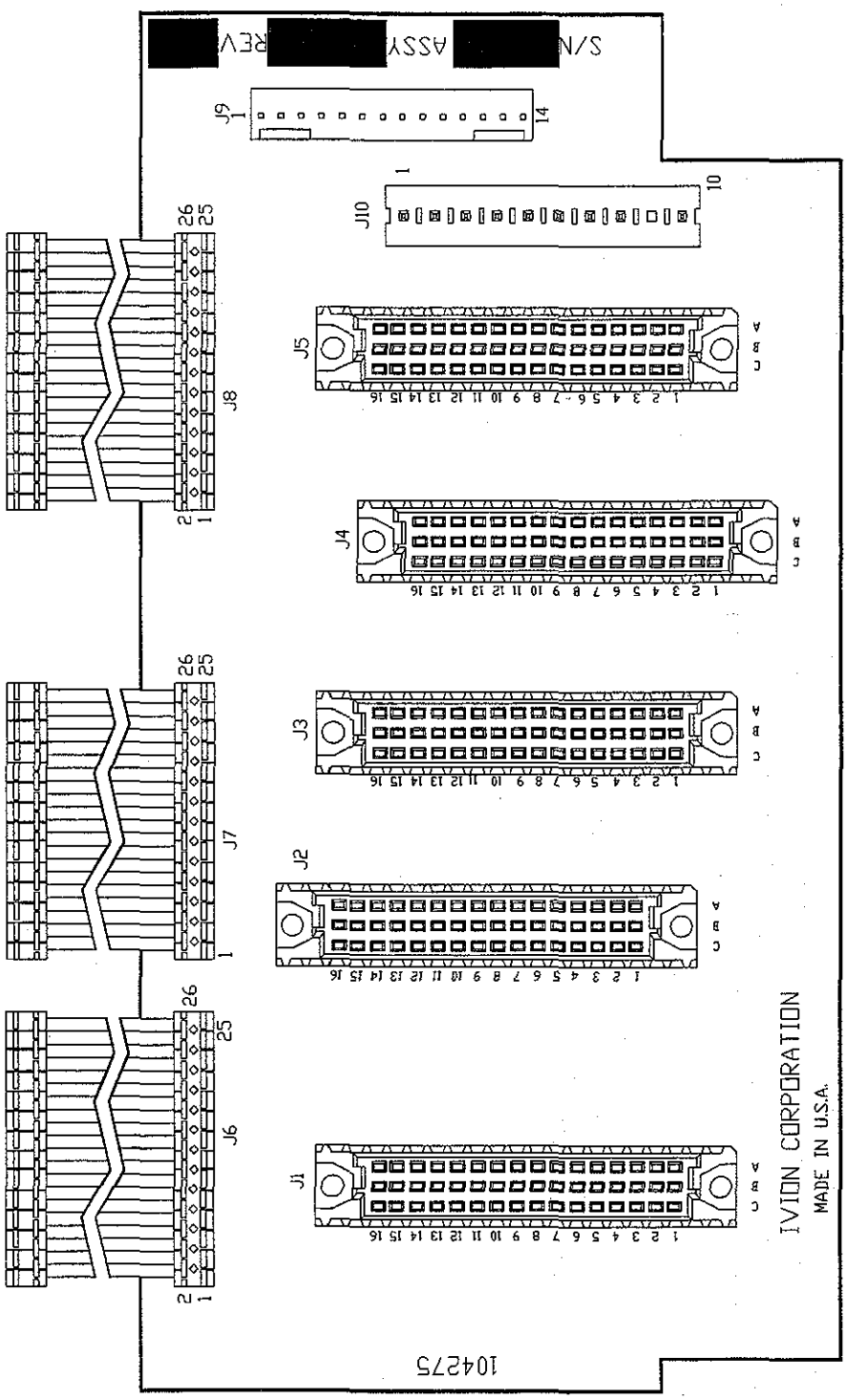
Line	Signal Name	J1 Micro 3	J2 Power Management	J3 Micro 2	J4 Common	J5 Micro 1	J6 Display 3	J7 Display 2	J8 Display 1	J9 Rear Panel	J10 Pwr Supply /Battery	See Note
35	CH2AD2	-	-	14C	-	-	-	9	-	-	-	
36	CH2AD3	-	-	13C	-	-	-	13	-	-	-	
37	CH2AD4	-	-	12C	-	-	-	15	-	-	-	
38	CH2AD5	-	-	11C	-	-	-	11	-	-	-	
39	CH2AD6	-	-	10C	-	-	-	7	-	-	-	
40	CH2AD7	-	-	9C	-	-	-	3	-	-	-	
41	CH2ALE	-	-	9B	-	-	-	17	-	-	-	
42	CH2CLSW*	-	10A	5A	-	-	-	-	-	-	-	
43	CH2ON	-	8A	6B	-	-	-	-	-	-	-	
44	CH2PWRSW*	-	3B	-	-	-	-	22	-	-	-	
45	CH2RD*	-	-	7C	-	-	-	19	-	-	-	
46	CH2RESET*	-	9A	8C	-	-	-	18	-	-	-	
47	CH2SEL*	-	-	6C	-	-	-	20	-	-	-	
48	CH2SPARE1	-	-	7A	5C	-	-	-	-	-	-	
49	CH2SPARE2	-	-	11B	6C	-	-	-	-	-	-	
50	CH2SYSCHK*	-	13B	16B	-	-	-	2	-	-	-	
51	CH2TS	-	-	14A	6B	-	-	-	-	-	-	
52	CH2TXD	-	-	15A	8A	-	-	-	-	-	-	
53	CH2VCC	-	15A,15B	4A,4C	3C	-	-	23,25	-	-	-	
54	CH2VMTR	-	3C	3A,3B,3C	-	-	-	-	-	-	-	
55	CH2WR*	-	-	5C	-	-	-	21	-	-	-	
56	CH3AD0	16C	-	-	-	-	1	-	-	-	-	
57	CH3AD1	15C	-	-	-	-	5	-	-	-	-	
58	CH3AD2	14C	-	-	-	-	9	-	-	-	-	
59	CH3AD3	13C	-	-	-	-	13	-	-	-	-	
60	CH3AD4	12C	-	-	-	-	15	-	-	-	-	
61	CH3AD5	11C	-	-	-	-	11	-	-	-	-	
62	CH3AD6	10C	-	-	-	-	7	-	-	-	-	
63	CH3AD7	9C	-	-	-	-	3	-	-	-	-	
64	CH3ALE	9B	-	-	-	-	17	-	-	-	-	
65	CH3CLSW*	5A	2A	-	-	-	-	-	-	-	-	
66	CH3ON	6B	6A	-	-	-	-	-	-	-	-	
67	CH3PWRSW*	-	2B	-	-	-	22	-	-	-	-	
68	CH3RD*	7C	-	-	-	-	19	-	-	-	-	

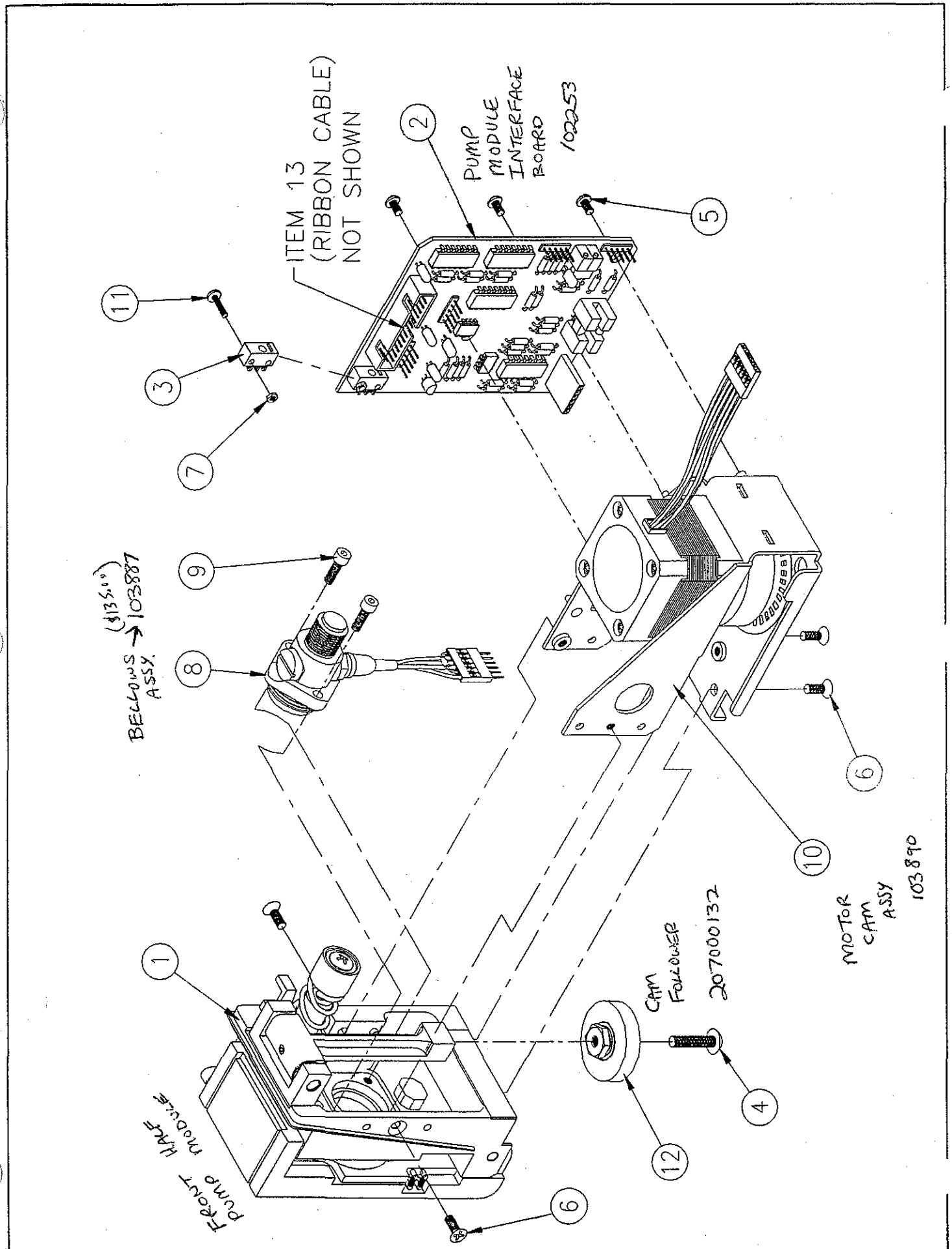
Line	Signal Name	J1 Micro 3	J2 Power Management	J3 Micro 2	J4 Common	J5 Micro 1	J6 Display 3	J7 Display 2	J8 Display 1	J9 Rear Panel	J10 Pwr Supply /Battery	See Note
69	CH3RESET*	8C	4C	-	-	-	18	-	-	-	-	
70	CH3SEL*	6C	-	-	-	-	20	-	-	-	-	
71	CH3SPARE1	7A	-	-	7C	-	-	-	-	-	-	
72	CH3SPARE2	11B	-	-	8C	-	-	-	-	-	-	
73	CH3SYSCHK*	16B	13C	-	-	-	2	-	-	-	-	
74	CH3TS	14A	-	-	13C	-	-	-	-	-	-	
75	CH3TXD	15A	-	-	7B	-	-	-	-	-	-	
76	CH3VCC	4A,4C	15C,16C	-	15C	-	23,25	-	-	-	-	
77	CH3VMTR	3A,3B,3C	2C	-	-	-	-	-	-	-	-	
78	CH3WR*	5C	-	-	-	-	21	-	-	-	-	
79	CHARGE	-	12A	-	-	-	-	-	16	-	-	
80	COMMON*	15B	-	15B	-	15B	4	4	4	-	-	
81	COMSCL	8A	7A	8A	10C	8A	-	-	-	-	-	
82	COMSDA	9A	8C	9A	10A	9A	-	-	-	-	-	
83	COMVCC	-	14A,14B	-	16A,16B,16C	-	-	-	-	-	-	
84	DPORT*	13B	-	13B	-	13B	8	8	8	-	-	
85	GND	1A,1B,1C	1A,1B,1C	1A,1B,1C	1A,1B,1C	1A,1B,1C	24,26	24,26	24,26	8	3,4	1
86	HSKI	8B	-	8B	9C	8B	-	-	-	-	-	
87	IBAT	7B	14C	7B	-	7B	-	-	-	-	-	
88	LINE*	-	13A	-	-	-	10	10	10	-	-	
89	LOBAT*	10B	-	10B	-	10B	14	14	14	-	-	
90	LOCK*	14B	-	14B	-	14B	6	6	6	-	-	
91	LOCKSW*	-	-	-	11A	-	-	-	-	10	-	
92	MTRGND	2A,2B,2C	-	2A,2B,2C	-	2A,2B,2C	-	-	-	-	-	1
93	NURSE*	12A	11B	12A	12C	12A	-	-	-	-	-	
94	NURSE1	-	-	-	15A	-	-	-	-	4	-	
95	NURSE2	-	-	-	11B	-	-	-	-	7	-	
96	PWRMVCC	-	12B	-	-	-	16	16	-	-	-	
97	RS232GND	-	-	-	-	-	-	-	-	14	3,4	2
98	RS232HSKI	-	-	-	12B	-	-	-	-	6	-	
99	RS232HSKO	-	-	-	7A	-	-	-	-	12	-	
100	RS232RXD	-	-	-	5A	-	-	-	-	13	-	
101	RS232TXD	-	-	-	9A	-	-	-	-	11	-	
102	RXD	13A	-	13A	14C	13A	-	-	-	-	-	

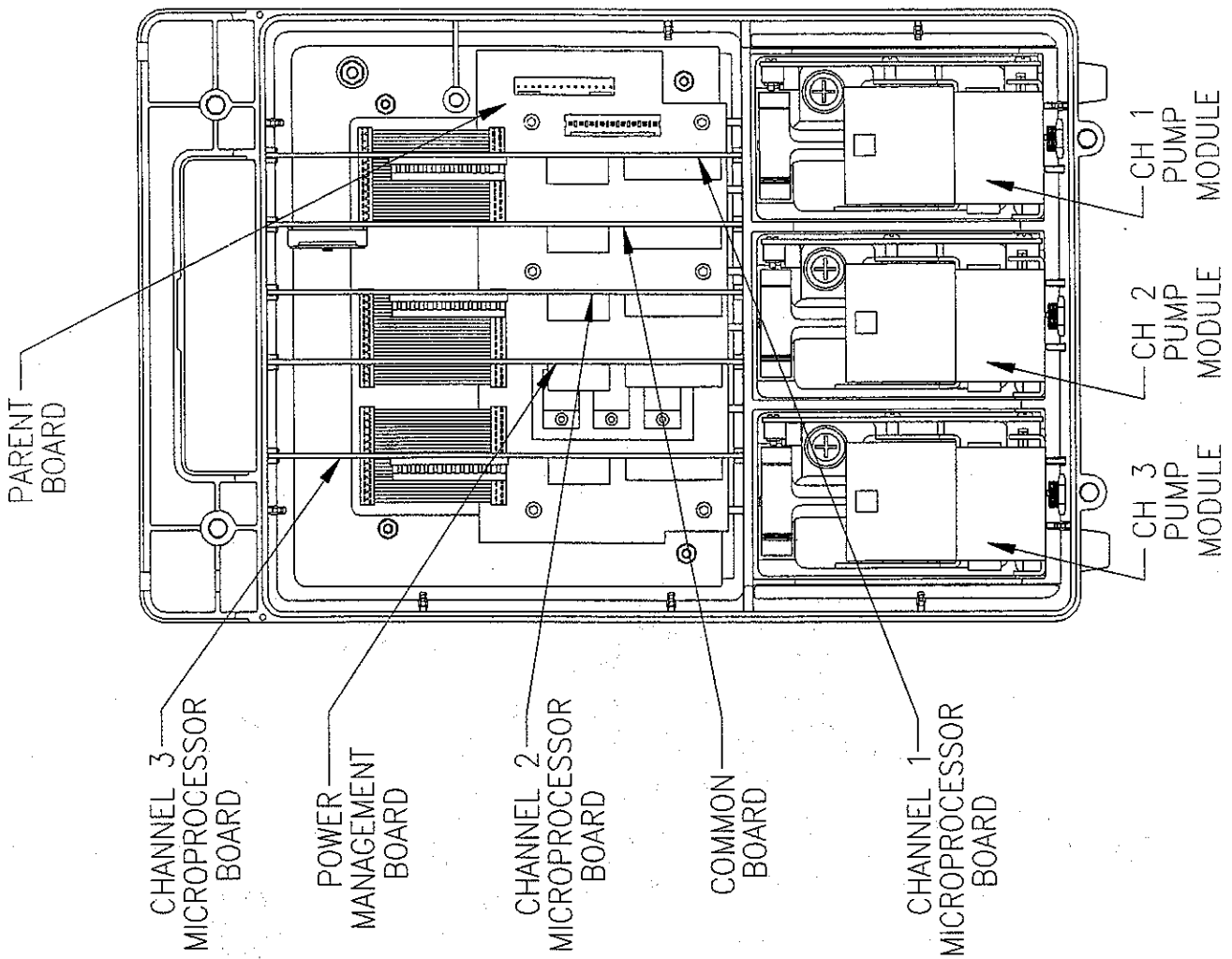
Line	Signal Name	J1 Micro 3	J2 Power Management	J3 Micro 2	J4 Common	J5 Micro 1	J6 Display 3	J7 Display 2	J8 Display 1	J9 Rear Panel	J10 Pwr Supply /Battery	See Note
103	SPARE2	12B	-	12B	13B	12B	-	-	-	-	-	
104	SPARE3	-	-	-	10B	-	-	-	-	-	-	
105	SPEAKER	-	-	-	15B	-	-	-	-	2	-	
106	SPKRCOM	-	-	-	14B	-	-	-	-	5	-	
107	TSCLK	5B	5A	5B	5B	5B	-	-	-	-	-	
108	VBAT	16A	9B	16A	-	16A	-	-	-	-	-	
109	VUNSWPWR	6A	11C	6A	4C	6A	-	-	-	-	-	

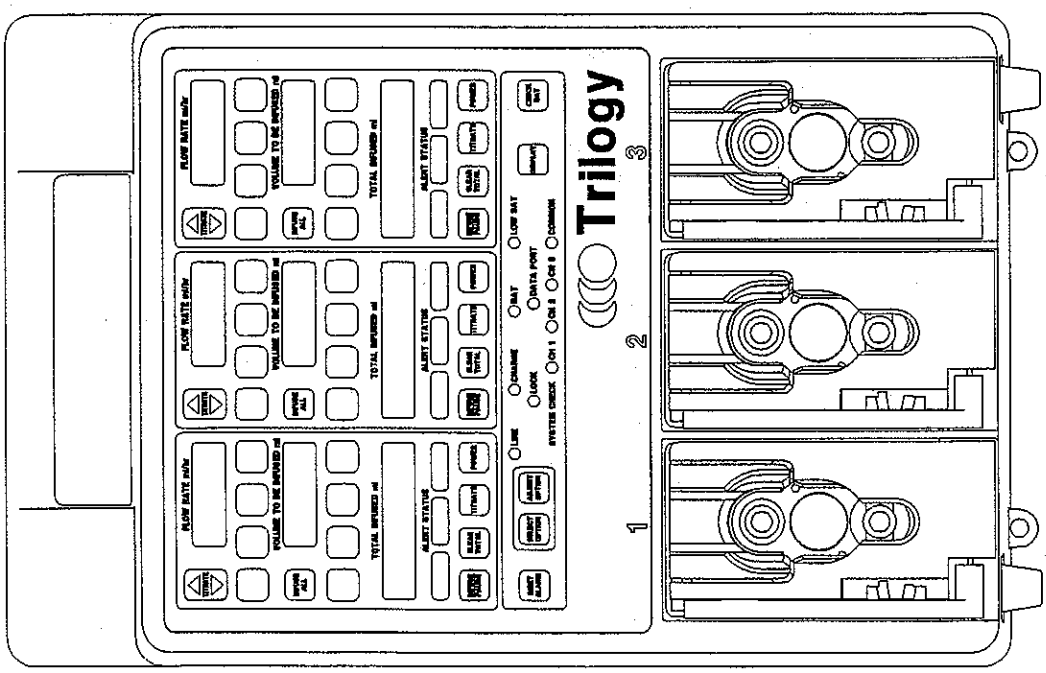
Notes:

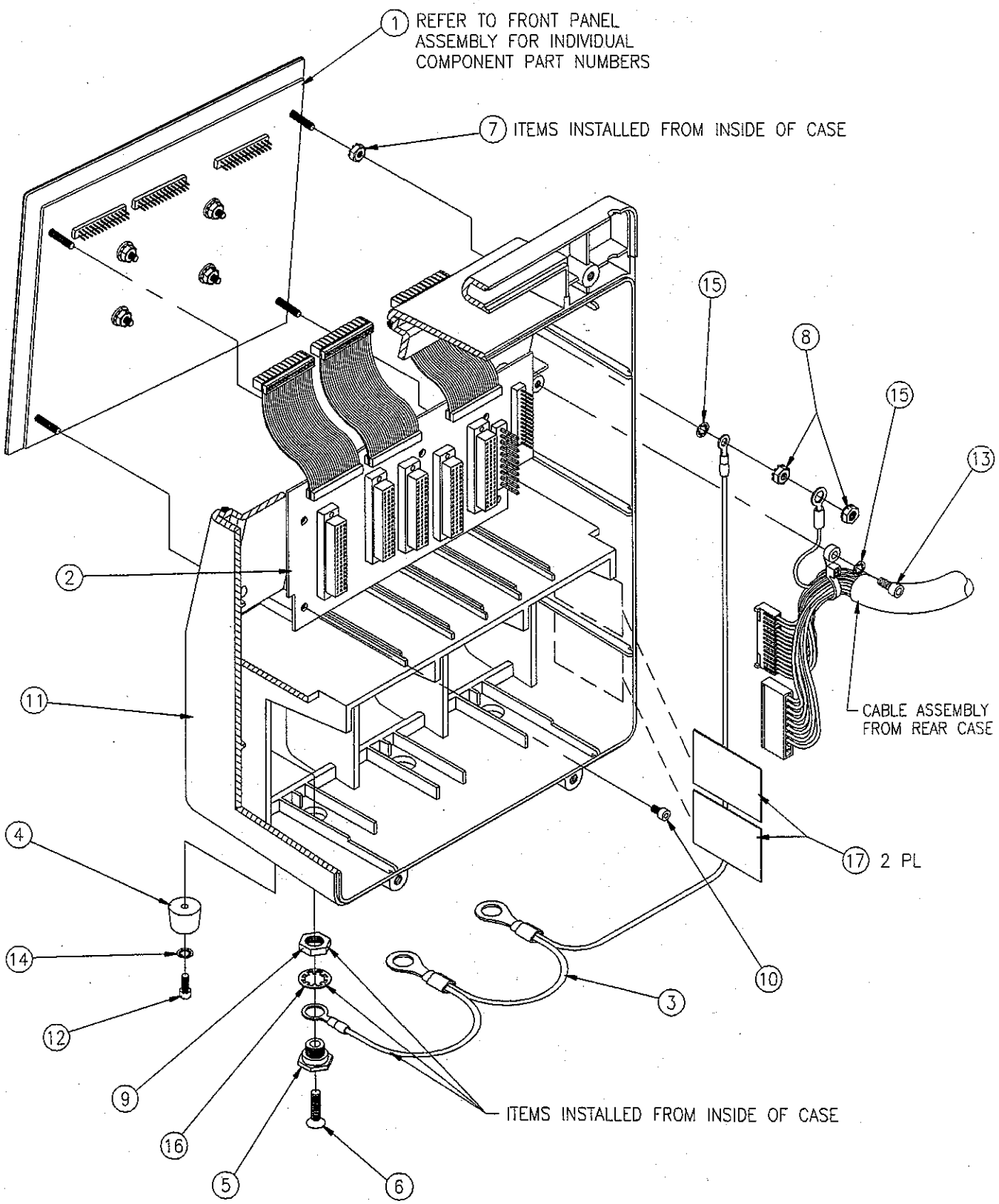
1. MTRGND connects to J2 directly at pins 1A, 1B, 1C (GND).
2. RS232GND is a single tap from J10-3,4 to J9-14.

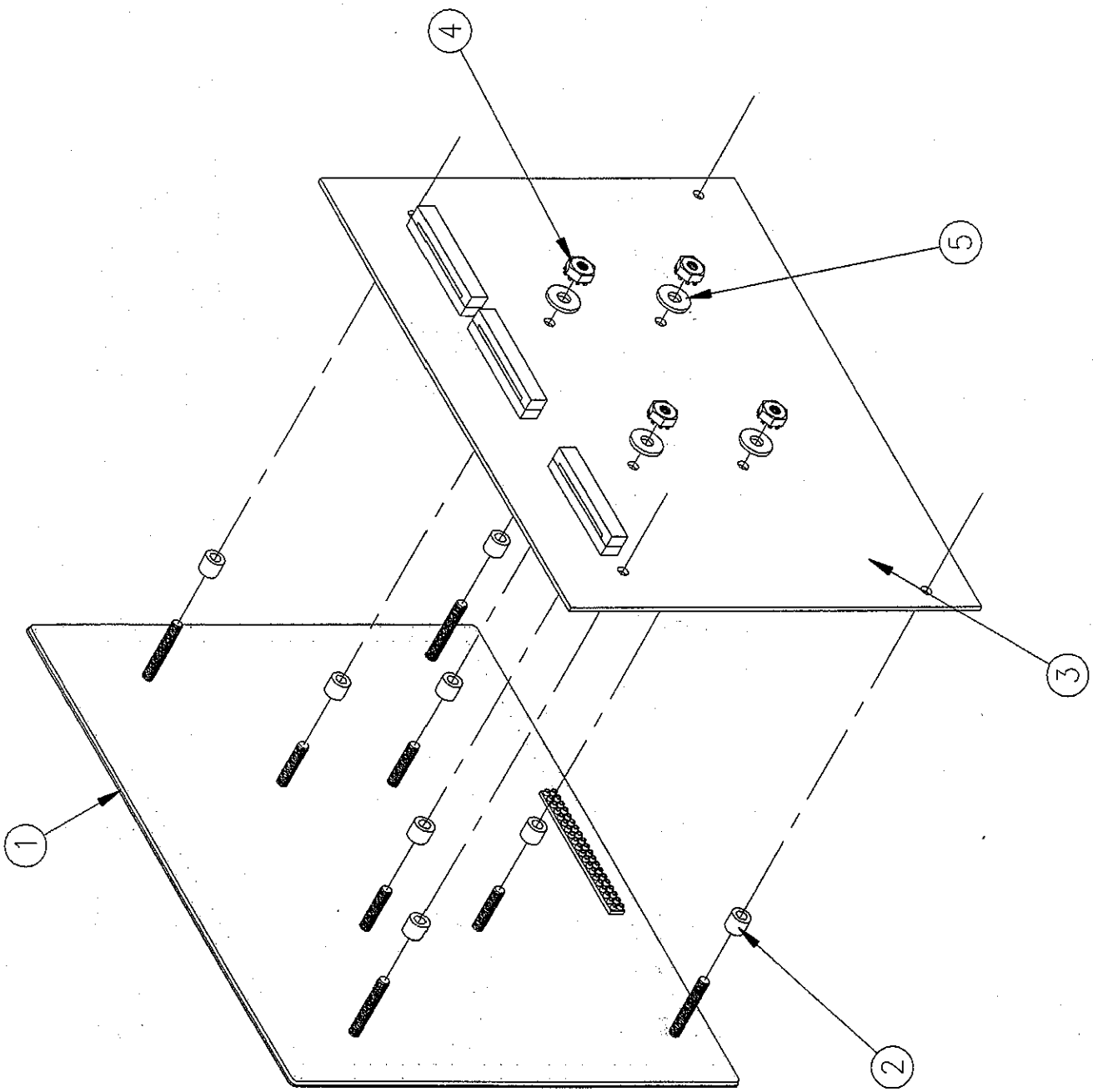

S/N [redacted] ASSY [redacted] REV [redacted]
J9
J10
J5
J4
J3
J2
J1
J8
J7
J6
IVION CORPORATION
MADE IN U.S.A.
104275

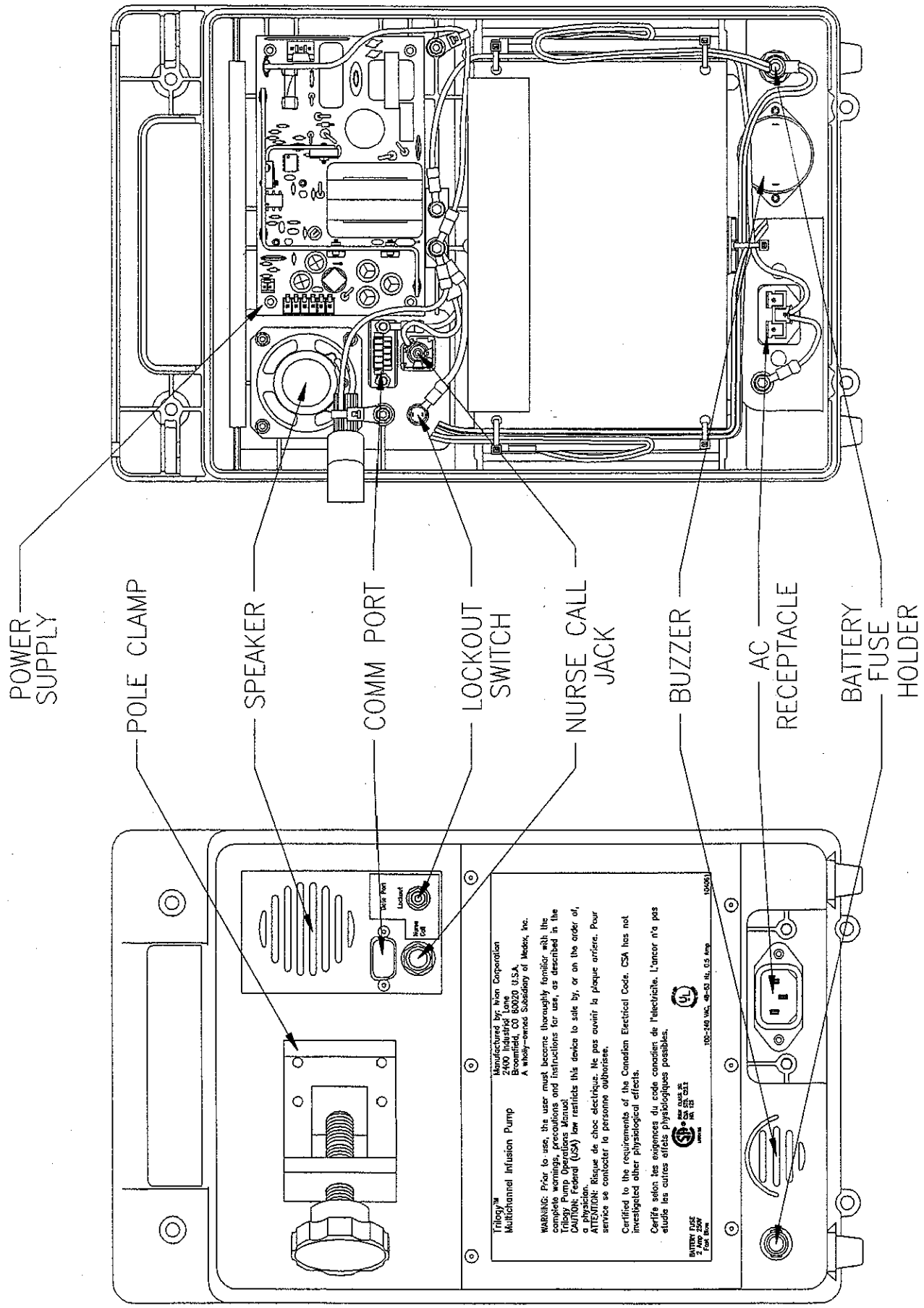

ITEM 13
(RIBBON CABLE)
NOT SHOWN
PUMP
MODULE
INTERFACE
BOARD
103253
BELLOWS
ASSY.
($135.00)
103887
FRONT
PUMP
MODULE
HALF
CAM
FOLLOWER
20700132
MOTOR
CAM
ASSY
103890

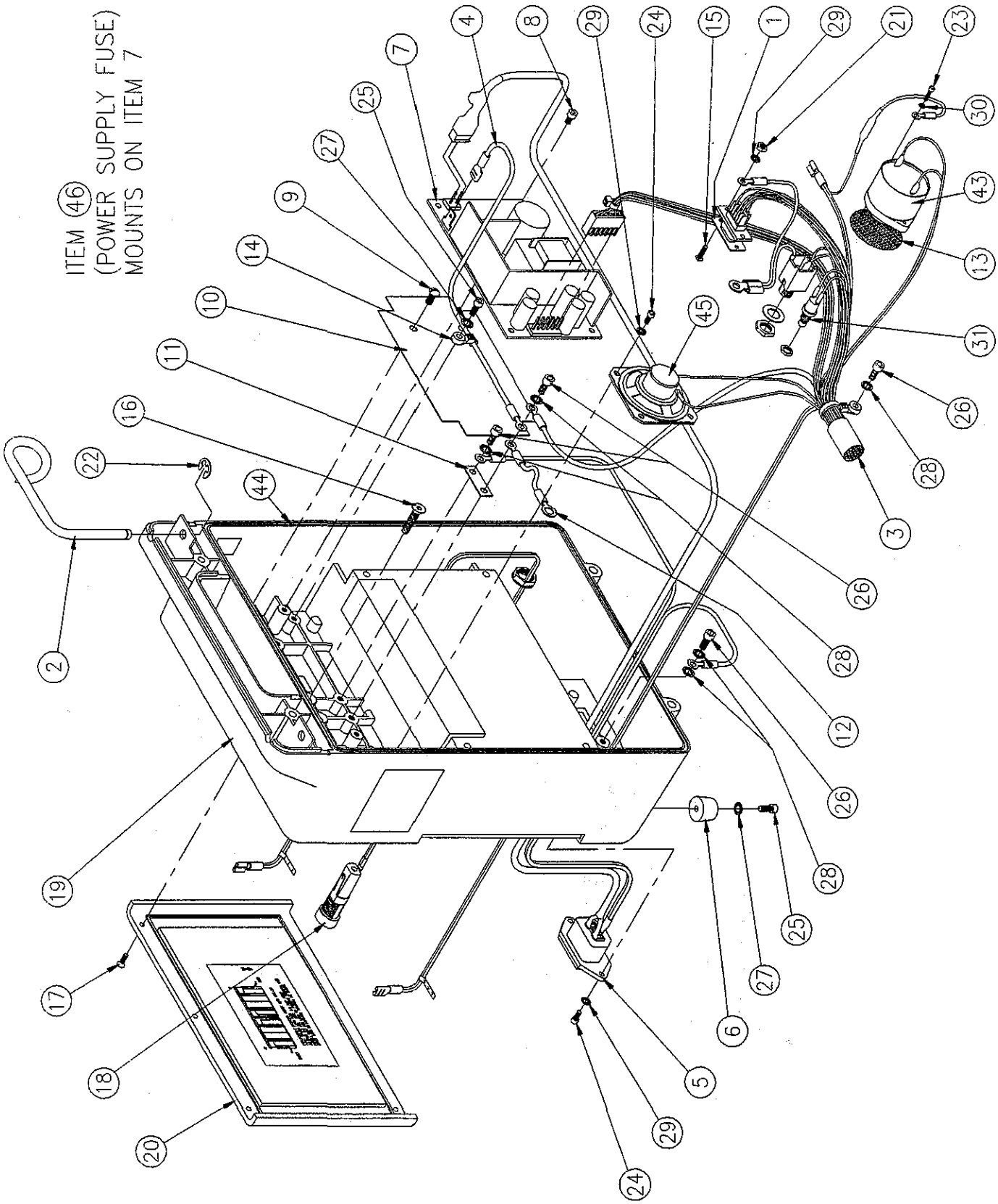

PARENT BOARD
CHANNEL 3 MICROPROCESSOR BOARD
POWER MANAGEMENT BOARD
CHANNEL 2 MICROPROCESSOR BOARD
COMMON BOARD
CHANNEL 1 MICROPROCESSOR BOARD
CH 1 PUMP MODULE
CH 2 PUMP MODULE
CH 3 PUMP MODULE

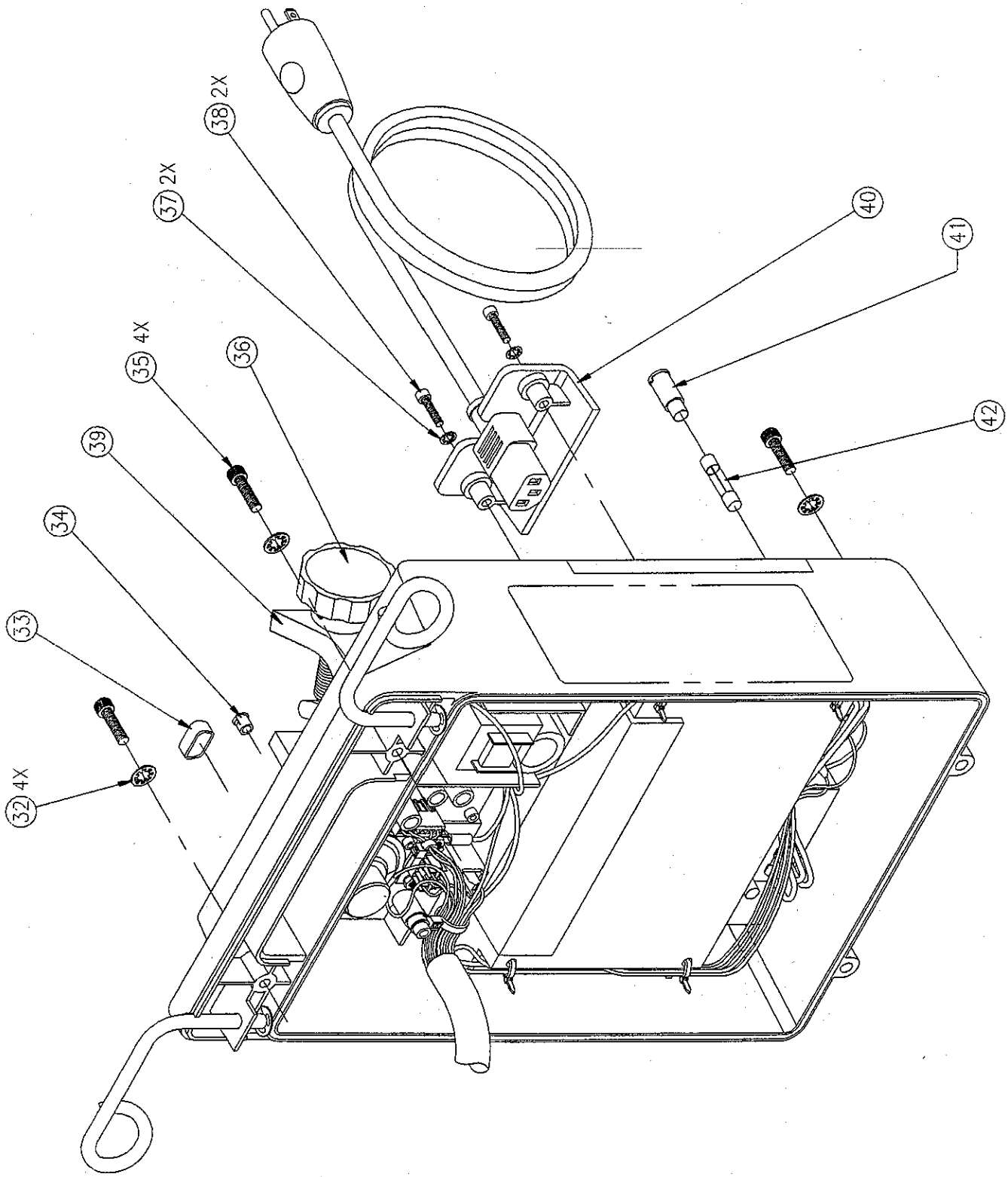

Trilogy
1
2
3


1 REFER TO FRONT PANEL ASSEMBLY FOR INDIVIDUAL COMPONENT PART NUMBERS
7 ITEMS INSTALLED FROM INSIDE OF CASE
15
8
15
13
2
11
CABLE ASSEMBLY FROM REAR CASE
4
17 2 PL
14
10
3
12
9
16
ITEMS INSTALLED FROM INSIDE OF CASE
5
6


4
5
3
1
2


POWER SUPPLY
POLE CLAMP
SPEAKER
COMM PORT
LOCKOUT SWITCH
NURSE CALL JACK
BUZZER
AC RECEPTACLE
BATTERY FUSE HOLDER
Trilogy™
Multichannel Infusion Pump
Manufactured by: Ivion Corporation
2400 Industrial Lane
Broomfield, CO 80020 U.S.A.
A wholly-owned Subsidiary of Medex, Inc.
WARNING: Prior to use, the user must become thoroughly familiar with the complete warnings, precautions and instructions for use, as described in the Trilogy Pump Operations Manual.
CAUTION: Federal (USA) law restricts this device to sale by, or on the order of, a physician.
ATTENTION: Risque de choc electrique. Ne pas ouvrir la plaque arriere. Pour service se contacter la personne autherisee.
Certified to the requirements of the Canadian Electrical Code. CSA has not investigated other physiological effects.
Certifié selon les exigences du code canadien de l'électricité. L'ancor n'a pas etudie les autres effets physiologiques possibles.
BATTERY FUSE
2 Amp 250V
Fast Blow
100-240 VAC, 48-63 Hz, 0.5 Amp
10406

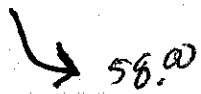

ITEM 46
(POWER SUPPLY FUSE)
MOUNTS ON ITEM 7
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
43
44
45


38 2X
37 2X
40
41
35 4X
36
42
39
34
33
32 4X

Section 8.0
Parts Lists

Major Subassemblies

DESCRIPTION	SOFTWARE VER 1.3	SOFTWARE VER 1.5
Microprocessor Board	102256	068MICRO00
Display Board	105240	105240
Control Panel	101843	101843
Pump Module	102251	102251
Pump Module Interface Board	102253	102253
Common Board	102258	102258
Power Management Board	105374	105374
Power Supply Board	102304	102304
Parent Board	102261	102261
Power Cord	102279	102279
Main Battery	104134	104134



REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
C1	CAPC AL ELECT 100UF 25V 20%	102484
C12	CAPC TANTALUM 10UF 25V 20%	204102028
C2,C3,C9,C10	CAPC MONO CERAMIC COG 27PF 50V 10%	101976
C4-7,C11,CX1-CX17	CAPC MONO CERAMIC Z5U 0.1UF 50V 20%	204118007
C8	CAPC MONO CERAMIC COG 15PF 50V 10%	102179
D1,D2,D3,D4	DIODE 1N4148 SIGNAL	100182
P1	HEADER 2x13 SHROUDED .025 SQ PIN	101979
P2	CONNECTOR DIN 48 PIN 1/2C RGT ANGLE	101981
Q1-Q7	TRANSISTOR N CHANNEL MOSFET	102107
Q8,Q9	TRANSISTOR P CHANNEL JFET	101982
R1	RESISTOR CC/CF 2.2K 5% 1/4W	234024071
R11,R15,R20,R23	RESISTOR CC/CF 47K 5% 1/4W	234024103
R13	RESISTOR CC/CF 10M 5% 1/4W	234024158
R14,R18	RESISTOR MF 10.0K 1% 1/8W	234201385
R16	RESISTOR MF 18.2K 1% 1/8W	234201410
R17	RESISTOR MF 21.5K 1% 1/8W	234201417
R19	RESISTOR MF 26.1K 1% 1/8W	234201425
R2,R3,R4,R5,R12	RESISTOR CC/CF 4.7K 5% 1/4W	234024079
R21,R22	RESISTOR CC/CF 1M 5% 1/4W	234024135
R24,R25	RESISTOR CC/CF 24K 5% 1/4W	234024096
R6	RESISTOR CC/CF 10K 5% 1/4W	234024087
R7	RESISTOR CC/CF 10 OHM 5% 1/4W	234024015
R8,R9,R10	RESISTOR CC/CF 1.0K 5% 1/4W	234024063
RP1	RES NETWORK 5X47K SIP 6 PIN 5%	102387
RP2	RES NETWORK 9X47K SIP 10 PIN 5%	102388
RP3	RES NETWORK 8X220K DIP 16 PIN 5%	103400
RP4	RES NETWORK 5X10K SIP 10 PIN ISOLAT	103463
TP1	HEADER 1X15 .025 SQ PIN .1 CTR	208188015
U1	IC RAM 8Kx8 150NS CMOS STATIC	102002
U10	IC 74AC32 QUAD 2 INPUT OR GATE	101993
U11	IC 74AC245 OCTAL BUS TRANSCEIVER	101990
U13	IC 74HC04 HEX INVERTER	101999
U14	IC ULN2003AN 7 CHANNEL DARLINGTON	102000
U16	IC 74HC74 DUAL D TYPE FLIP FLOP	101997
U17	IC LM393N DUAL COMPARATOR	210300011
U18	IC TLC272 CMOS DUAL OP AMP HI BIAS	102200
U2	EPROM MICRO BOARD PROGRAM VER 1.3 (For 102256 Assembly)	104842
U2	EPROM MICRO BOARD PROGRAM VER 1.5 (For 068MICRO00 Assembly)	068EPROM00
U3	IC 74AC573 OCTAL TRANSPARENT LATCH	101989
U4	IC 80C198 PLCC MICROCONTROLLER	101994
U5	PLD MICRO BD PROGRAMMED TRILOGY	102255
U6	IC PCD8584 I2C CONTROLLER	101992
U7,15	IC 74HC273 OCTAL D FLIP FLOP	102001
U8,U12	IC LTC 691 RESET 1V WATCHDOG TIMER	104977

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
U9	IC 74HC541 OCTAL LINE DRIVE RECEIVE	101998
VR1	IC LT1009CLP PRECISION REF 2.5V	102004
Y1	CRYSTAL 10.0M PARALLEL .05% HC-49S	102445
Y2	CRYSTAL 6.0M PARALLEL .05% HC-49S	102444
	BOARD EXTRACTOR	102228
	NUT HEX 2-56	224011003
	SCREW PAN HEAD 2-56 1/2 PHILIPS SS	102804
	SCREW SELF TAPPING 6-20 X 3/8	102408
	WASHER LOCK INTERNAL TOOTH #2	253008007
	(U2),SOCKET IC 28 PIN MACHINED CONTACT	102007
	(U4),SOCKET IC 52 PIN JEDEC TYPE A PLCC	102008

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
C1-C6,C102-111,C202-211,C302-312	CAPC MONO CERAMIC Z5U 0.1UF 50V	102059
C101,C201,C301	CAPC TANTALUM 10UF 10V 20% AXIAL	102058
D1,D101,D102,D201,D202,D301,D302	DIODE COMPUTER 1N4152	102060
DS101-108,DS201-208,DS301-308	DISPLAY 7 SEGMENT HIGH EFF RED	102061
DS109-110,DS209-210,DS309-310	DISPLAY 4 CHAR ALPA HIGH EFF RED	102062
E1,E3,E6,E101-103,E201-203, E301-303	LED GREEN HIGH EFFICIENCY T-1	102064
E2,E4,E104-106,E204-206,E304-306	LED YELLOW HIGH EFFICIENCY T-1	102065
E5,E7,E107-110,E207-210,E307-310	LED RED HIGH EFFICIENCY T-1	102066
J1	CONNECTOR LOW PROFILE 40 POS MALE	102063
P101,P201,P301	CONNECTOR 2X13 POSITION HEADER	103839
R1	RESISTOR CC/CF 180 OHM 5% 1/4W	234024045
R101-102,R201-202,R301-302	RESISTOR CC/CF 10K 5% 1/4W	234024087
R203,R303	RESISTOR CC/CF 120 OHM 5% 1/4W	234024041
RP1	RES NETWORK 7X120 OHM SIP 8 PIN	102243
RP101,RP201,RP301	RES NETWORK 8X82 OHM DIP 16 PIN (For 102248 Assembly)	102244
RP101,RP201,RP301	RES NETWORK 8X270 OHM DIP 16 PIN (For 105240 Assembly)	105234
RP102-103,RP202-203,RP302-303	RES NETWORK 3X68 OHM SIP 6 PIN	102245
RP104,RP204,RP304	RES NETWORK 3X68 OHM SIP 6 PIN (For 102248 Assembly)	102245
RP104,RP204,RP304	RES NETWORK 3X120 OHM SIP 6 PIN (For 105240 Assembly)	105235
RP106,RP207,RP306	RES NETWORK 7X10K SIP 8 PIN	102246
RP107,RP205,RP307	RES NETWORK 5X10K SIP 6 PIN COMMOM	102025
RP2	RES NETWORK 5X470K SIP 6 PIN	102771
RP3,RP105,RP206,RP305	RES NETWORK 5X100K SIP 10 PIN	102773
U1	IC 74HC14 HEX INV	210230004
U101,U108,U204-205,U305,U310	IC ULN2803A	210100020
U102,U203,U301	IC 74AC573 OCTAL TRANSPARENT LATCH	101989
U103,U202,U304	IC UDN2585A	210100019
U104,U207,U303	PLD DISPLAY BD PROGRAMMED TRILOGY	104803
U105,U206,U306	IC 74AC564 OCTAL D FLIP FLOP	102073
U106,U210,U309	IC 74HC4514 1 OF 16 DECODE/DEMULTI	102071
U107,U109,U201,U208,U302,U307	IC 74HC540 OCTAL BUFFER INVERTING	102070
U110,U209,U308	IC 74HC05 HEX INVERTER	102069
	LED MOUNT T-1 .110	103838
	SPACER 0.2CTR .060 HEIGHT	102075
	SPACER 0.6CTR .060 HEIGHT	102076

Front Panel Assembly

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
1	CONTROL PANEL TRILOGY	101843
2	SPACER FRONT PANEL TRILOGY	102225
3	DISPLAY BOARD TRILOGY (For 1.3 Software)	102248
3	DISPLAY BOARD TRILOGY (For 1.4 Software)	105245
4	NUT HEX KEPS 6-32 SMALL PATTERN	102760
5	WASHER NYLON .040 ID 5/16 OD	253200032

Reference designators are shown on the Front Panel Assembly drawing on page 7-29.

Pump Module *102251*

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
1	FRONT HALF PUMP MODULE	
2	PUMP MODULE INTERFACE BOARD	102253
3	CASSETTE/DOOR SWITCH	103427
4	SCREW, 8-32 PHILLIPS TRUSS HD 3/4"	103758
5	SCREW, 4-40 X 7/32" PN HD PHIL NYPATCH	103767
6	SCREW, 6-32 X 3/8" FL HD PHIL NYPATCH	103769
7	NUT 2 MM	103772
8	BELLOWS ASSEMBLY	103887
9	SCREW, 6-32 X 7/16" NYPATCH SCK HD CAP	103888
10	MOTOR/CAM ASSEMBLY	103890
11	SCREW, 2MM X 10MM PN HD NYPATCH	104463
12	CAM FOLLOWER	207000132
13	PUMP MODULE RIBBON CABLE	102265

Reference designators are shown on the Pump Module Assembly drawing on page 7-26.

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
C1,C7	CAPC TANTALUM 10UF 25V 20%	204102028
C2	CAPC TANTALUM 22UF 25VDC	104135
C3,C4,C6,C8,C11,C12,C14-C17	CAPC MONO CERAMIC Z5U 0.1UF 50V 20%	204118007
C5,C9,C10,C13	CAPC MONO CERAMIC X7R 1NF 100V 10%	204200025
J3	SOCKET STRIP 6 PIN .735 HIGH	102516
L1	INDUCTOR 10UH 500MADC DCR <0.7 OHM	PART 102453
P1	HEADER 2x13 SHROUDED .025 SQ PIN	101979
P2	HEADER 1X6 .025 SQ PIN .1 CTR	208188006
Q1,Q2	TRANSISTOR 2N3904 NPN	100344
R1,R9	RESISTOR CF 1 OHM 5% 1/4W	102096
R11-R13,R15,R22	RESISTOR MF 24.9K 1% 1/8W	234201423
R14,R24,R25	RESISTOR MF 100K 1% 1/8W	234201481
R16,R19,R20	RESISTOR MF 21.5K 1% 1/8W	234201417
R17,R34	RESISTOR MF 10.7K 1% 1/8W	234201388
R2,R6,R10,R18,R33	RESISTOR CC/CF 1.0K 5% 1/4W	234024063
R21,R29	RESISTOR CC/CF 10K 5% 1/4W	234024087
R23	RESISTOR MF 7.15K 1% 1/8W	234201371
R26,R27	RESISTOR CC/CF 8.2K 5% 1/4W	234024085
R28,R35	RESISTOR CC/CF 220 OHM 5% 1/4W	234024047
R3,R4,R30	RESISTOR CC/CF 33K 5% 1/4W	234024099
R31,R32	TRIMPOT 2K 10% 12 TURN CERMET	102496
R5	RESISTOR CC/CF 51 OHM 5% 1/4W	234024032
R7	RESISTOR MF 46.4K 1% 1/8W	234201449
R8	RESISTOR MF 3.74K 1% 1/8W	234201344
SW1	SWITCH SPDT BUTTON SIDE MOUNT	103427
TP1,TP2,TP3	HEADER 1X5 .025 SQ PIN .1 CTR	208188005
U1,U4	IC 3717A BIPOLAR MOTOR DRIVER	102308
U2	IC I2C EPROM	102098
U3	IC 74HC00 QUAD 2 INPUT NAND GATE	101996
U5	IC LM358AN	210300013
U6	IC LM324N QUAD AMP	210022000
U7,U8	IC H22A2 SLOT SWITCH	102307
U9	IC LM393N DUAL COMPARATOR	210300011
VR1	IC 78LO8 VOLTAGE REGULATOR 8V	102309
	NUT 2MM	103772
	SCREW 2-0.4 MMX10 PAN HD NYPATCH	104463

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
BT1	BATTERY 3V COIN CELL 24.5MM x3.0MM	102177
C1	CAPC MONO CERAMIC COG 15PF 50V 10%	102179
C10,C11,C15	CAPC POLYESTER FILM 1UF 63V 10%	102182
C12	CAPC MONO CERAMIC COG 22PF 50V 10%	102180
C13	CAPC MONO CERAMIC COG 82PF 50V 10%	102181
C14, CX1-CX20	CAPC MONO CERAMIC Z5U 0.1UF 50V 20%	204118007
C19	CAPC MONO CERAMIC Z5U .01UF 50V 20%	204118001
C2	CAPC AL ELECT 100UF 25V 20%	102484
C21,C22	CAPC TANTALUM 10UF 25V 20%	204102028
C3,C16	CAPC POLYESTER FILM 0.1UF 63V 10%	102184
C4,C5	CAPC MONO CERAMIC Z5U 50V 20% .001U	204121060
C6,C7,C8,C9	CAPC TANTALUM 1.0UF 35V 20%	204104042
D1,D2,D3,D5,D6,D7	DIODE 1N4148 SIGNAL	100182
K1	RELAY DIP SPST 5VDC COIL .5A	230006001
P1	CONNECTOR DIN 48 PIN 1/2C RGT ANGLE	101981
Q1-Q4,Q6	TRANSISTOR N CHANNEL MOSFET	102107
Q5	TRANSISTOR PNP 2N3906	239047000
Q7	TRANSITOR,PMOS,30V,VP0300L	100181
R1,R2	RESISTOR CC/CF 2.2K 5% 1/4W	234024071
R10	RESISTOR CC/CF 7.5K 5% 1/4W	234024084
R11,R19,R27	RESISTOR CC/CF 5.1K 5% 1/4W	234024080
R12,R25	RESISTOR CC/CF 22K 5% 1/4W	234024095
R13,R26,R30,R34	RESISTOR CC/CF 3.9K 5% 1/4W	234024077
R17	RESISTOR CC/CF 470K 5% 1/4W	234024127
R18,R29	RESISTOR CC/CF 75K 5% 1/4W	234024108
R23,R38	RESISTOR CC/CF 240K 5% 1/4W	234024120
R24,R35,R45	RESISTOR CC/CF 100K 5% 1/4W	234024111
R3-R5,R15	RESISTOR CC/CF 1.0K 5% 1/4W	234024063
R31,R36	RESISTOR CC/CF 10M 5% 1/4W	234024158
R33	RESISTOR CC/CF 680K 5% 1/4W	234024131
R37	RESISTOR CC/CF 33K 5% 1/4W	234024099
R39	RESISTOR CF 1 OHM 5% 1/4W	102096
R40-R44	RESISTOR CC/CF 100 OHM 5% 1/4W	234024039
R6-R7,R14,R16,R20-R22,R28,R47-R51	RESISTOR CC/CF 10K 5% 1/4W	234024087
R8	RESISTOR CC/CF 15K 5% 1/4W	234024091
R9	RESISTOR CC/CF 47K 5% 1/4W	234024103
TP1	HEADER 1X15 .025 SQ PIN .1 CTR	208188015
TVS2-TVS5	DIODE TVS 500W 15V BI-DIRECTIONAL	102460
U1	IC PCF8574 12C I/O'	102194
U10	IC LM386 AUDIO AMPLIFIER	102199

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
U11	IC 4521 24 STAGE FREQUENCY DIVIVER	102195
U12	PLD COMMON BD PROGRAMMED TRILOGY	102257
U13	IC TLC272 CMOS DUAL OP AMP HI BIAS	102200
U14	IC 4538 DUAL MONO MULTI VIBRATOR	104011
U16	IC MM74C73N DUAL J-K FLIP FLOP CMOS	104583
U17	IC 74HC11 TRIPLE 3 INPUT AND GATE	102204
U2	IC 4051 8 CHANNEL ANALOG MULTIPLEX	102198
U3	IC 74HC125 QUAD 3 ST NON INVERT BUF	102205
U4	IC PCF8583 12C RAM CLOCK CALENDAR	102201
U5	IC 74HC74 DUAL D TYPE FLIP FLOP	101997
U6	IC DUAL DRIVER RECEIVER RS-232 5V	102206
U7	IC 4569 PROG DIV DUAL 4 BIT COUNTER	102196
U8	IC 74HC193 SYNCRONOUS UP/DOWN CTR	102197
U9	IC QUAD OPAMP LOWER POWER OFFSET	102099
VR1	IC 79L05 VOLTAGE REGULATOR -5V TO92	102207
VR2	ICLM78L 6.2V 10MA VOLTAGE REGULATOR	104215
Y1	CRYSTAL 32.768KHZ RS<41K CL=10PF	102208
Y2	CRYSTAL 2.000MHZ SERIES HC49U	102461
	BOARD EXTRACTOR TRILOGY	102228
	NUT HEX 2-56 UNC-2B STEEL NICKEL PL	224011003
	SCREW PAN HEAD 2-56 1/2 PHILIPS SS	102804
	SCREW SELF TAPPING 6-20 X 3/8	102408
	WASHER LOCK INTERNAL TOOTH #2	253008007
	WIRE BULK 30 AWG SOLID COPPER GREEN	255090004
	BATTERY HOLDER COIN CELL 24.5x3.0MM	102178

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
C1 C2	CAPC CERAMIC .68uF 50V 10% X 7R RAD	104931
C11	CAPC AL ELECT 470UF 25V LOW ESR	102627
C16 C17 C29 C31	CAPC TANTALUM 10UF 25V 10%	204102008
C21-C26	CAPC MONO CERAMIC COG 22PF 50V 10%	102180
C3 C20	CAPC MONO CERAMIC Z5U .01UF 50V 20%	204118001
C30	CAPC TANTALUM 22UF 10V 20%	204111012
C4	CAPC MONO CERAMIC COG 3.3NF 50V 5%	102623
C5 C6 C13 C33	CAPC AL ELECT 680UF 10V LOW ESR	102632
C7 C14 C15 C18 C19 C28 C32	CAPC AL ELECT 120UF 25V LOW ESR	102621
C8 C9 C10 C12 C27 CX1-CX14	CAPC MONO CERAMIC Z5U 0.1UF 50V 20%	204118007
D1 D4 D5 D6 D11 D12	DIODE 1N4148 SIGNAL	100182
D10 D17 D18	DIODE SCHOTTKY 1N5821 3 AMP 30V	102651
D14	DIODE TVS 500W 15V BI-DIRECTIONAL	102460
D2	DIODE 1N4002 - RECT (Rev D or lower)	239091002
D2	DIODE, 2 AMPS (Rev E or higher)	02220D0500
D7	DIODE 1N4002 - RECT	239091002
D3 D8 D9 D13 D15 D16	DIODE IN5819 SCHOTTKY	100184
F1	FUSE MINI AXIAL LEAD 1/8 AMP	102625
F2	FUSE MINI AXIAL LEAD 2.0 AMP	102624
L1 L3 L8 L11 L12	INDUCTOR INPUT FILTER TRILOGY	102506
L10	INDUCTOR 12V CONVERTER TRILOGY	102505
L2 L4 L5 L9	INDUCTOR 5V CONVERTER TRILOGY	102503
L6	INDUCTOR 15V CONVERTER TRILOGY	102504
L7	INDUCTOR 10UH 190MADC MAX DCR <1OHM	101980
P1	CONNECTOR DIN 48 PIN 1/2C RGT ANGLE	101981
Q1	TRANSISTOR TN0702N3 N CNL MOSFET	102646
Q10	TRANSISTOR MTPI2N05E N CNL MOSFET	102647
Q2 Q6 Q7 Q11-Q21	TRANSISTOR N CHANNEL MOSFET	102107
Q3	TRANSISTOR PNP 2N3906	239047000
Q4 Q5 Q8 Q9	TRANSISTOR TIP32B PNP POWER TO-220	102645
R1	TRIMPOT 2K 10% 12 TURN CERMET	102496
R14	RESISTOR CC/CF 620K 5% 1/4W	234024130
R15	RESISTOR MF 30.1K 1% 1/8W	234201431
R16	RESISTOR MF 46.4K 1% 1/8W	234201449
R17	RESISTOR CF1.0 OHM 5%1/2W(Rev D or lower)	103438
R17	RESISTOR 0.47 OHM 1 W (Rev E or higher)	010R470500
R18 R42	RESISTOR CC/CF 470 OHM 5% 1/4W	234024055
R19	RESISTOR CC/CF3.3K 5% 1/4W(Rev D or lower)	234024075
R2	RESISTOR MF 3.09K 1% 1/8W	234201336
R20	RESISTOR CC/CF 430 OHM 5% 1/4W	234024054
R21 R38 R41	RESISTOR CC/CF 10K 5% 1/4W	234024087
R22	RESISTOR CC/CF 330 OHM 5% 1/4W	234024051
R23	RESISTOR(1.8K - 18K) 5% 1/4W	104509
R24 R25	RESISTOR CC/CF 100K 5% 1/4W	234024111
R26	RESISTOR CC/CF 180K 5% 1/4W	234024117

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
R27	RESISTOR MF 6.04K 1% 1/8W	234201364
R28 R46	RESISTOR MF 10.0K 1% 1/8W	234201385
R3 R4	RESISTOR CC/CF 1M 5% 1/4W	234024135
R30 R32	RESISTOR MF 10.0K 0.1% 1/8W 25PPM	102648
R31 R33	RESISTOR MF 24.0K 0.1% 1/8W 25PPM	102649
R39	RESISTOR CC/CF 68K 5% 1/4W	234024107
R40	RESISTOR MF 113K 1% 1/8W	234201486
R43	RESISTOR CC/CF 270 OHM 5% 1/4W	234024049
R45	RESISTOR MF 1.15K 1% 1/8W	234201295
R48	RESISTOR CC/CF 10M 5% 1/4W	234024158
R49	RESISTOR MF 1.00K 1% 1/8W	234201289
R5 R29	RESISTOR CC/CF 2.2K 5% 1/4W	234024071
R50	RESISTOR MF 20.0K 1% 1/8W	234201414
R51 R52 R53	RESISTOR MF 24.9K 1% 1/8W	234201423
R54	RESISTOR CC/CF 3.9K 5% 1/4W	234024077
R55	RESISTOR WW 0.1 OHM 1% 1W	102650
R56 R57 R58	RESISTOR CF 10K 5% 1/8W	100214
R6 R12 R37	RESISTOR CC/CF 1.8K 5% 1/4W	234024069
R7 R11 R34	RESISTOR CC/CF 30K 5% 1/4W	234024098
R8 R13 R36	RESISTOR CF 1 OHM 5% 1/4W	102096
R9 R10 R35 R44 R47	RESISTOR CC/CF 1.0K 5% 1/4W	234024063
RP1	RES NETWORK 5X10K SIP 10 PIN ISOLAT	103463
RP10	RES NETWORK 3X47K SIP 4 PIN COMMON	103467
RP2	RES NETWORK 3X1.0M SIP 4 PIN COMMON	103465
RP3 RP7	RES NETWORK 3X10K SIP 6 PIN ISOLATE	103464
RP4 RP5 RP9	RES NETWORK 3X10K SIP 4 PIN COMMON	103466
RP6 RP8	RESISTOR NETWORK 3X1K SIP6 ISOLATED	104636
RT1	THERMISTOR NTC 50K @ 25C -5.1%/C (Rev D or lower)	103439
TP1	HEADER 1X17 .025 SQ PIN .1 CTR	208188017
U1	IC 4538 DUAL MONO MULTI VIBRATOR	104011
U2	IC 4521 24 STAGE FREQUENCY DIVIVER	102195
U3	IC AD654JN V TO F CONVERTER DIP	102634
U4 U6	IC LM324AN QUAD OP-AMP DIP 14 PIN	102635
U5	IC UC3906N LEAD ACID BATTERY CHGR	102626
U7	IC PCF8574 12C I/O	102194
U8	PLD POWER MGMT BD PROGRAMMED TRIL	104689
U9	IC MIC5015 HIGH SIDE MOSFET DRIVER	102636
VR1 VR3 VR4 VR6	IC LM2575 VOLTAGE CONVERTER 5V	102637
VR2	IC LT1009CLP PRECISION REF 2.5V	102004
VR5	IC LT1070CT SWITCHING REGULATOR	102639
VR7	IC 79L05 VOLTAGE REGULATOR -5V TO92	102207
VR8	IC MAX633 VOLTAGE CONVERTER +15V	102640
VR9	IC LM2936Z VOLTAGE REGULATOR 5V	102638
	BOARD EXTRACTOR TRILOGY	102228
	HEAT SINK (B) 4 T022O DEVICES CUST	102682
	HEAT SINK CUSTOM 3 TO-220 DEVICES	102644

Power Management Board (cont)

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
	INSULATOR TO-220 THERMALSIL	102618
	NUT HEX 2-56 UNC-2B STEEL NICKEL PL	224011003
	SCREW 4-40 1/4 SHCS NYPATCH	104711
	SCREW PAN HEAD 2-56 1/2 PHILIPS SS	102804
	SCREW 4-40 1/4 SHCS NYPATCH	104711
	SCREW PAN HEAD 2-56 1/2 PHILIPS SS	102804
	SCREW SELF TAPPING 6-20 X 3/8	102408
	SOCKET IC 44 PIN JEDEC TYPE A PLCC	103391
	TRANSISTOR 0.2 SPACER POWER	104473
	WASHER INSULATING #4 .135X.2150D	102617
	WASHER LOCK INTERNAL TOOTH #2	253008007

Parent Board *102261*

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
J1-J5	CONNECTOR PC FEMALE EURO 3/16	102108
J9	HEADER 14 POS MALE .1 CTR	102296
J6,J7,J8	ASSY CABLE IDC MALE PCB SOCKET 3	103840
J10	HEADER 10 POS .156 CTRS W/0 RAMP	103854

Front Case Assembly

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
1	ASSY FRONT PANEL TRILOGY	REF ONLY
2	ASSY PARENT PCB TRILOGY	102261
3	ASSY CABLE PUMP MODULE GND TRILOGY	102269
4	FOOT RUBBER	102278
5	BULKHEAD FITTING PUMP MOD TRILOGY	102280
6	SCREW FLAT HD CAP 10-32 X 5/8"	105375
7	NUT HEX KEPS 6-32 SMALL PATTERN	102760
8	NUT HEX KEPS 8-32	102761
9	NUT PANEL 3/8-32	102762
10	SCREW SOCKET HEAD 6-32 1/4 NYLOK	103239
11	ASSEMBLY CASE FRONT SERVICE	105301
12	SCREW SOCKET HEAD CAP 6-32 3/8	237037069
13	SCREW SOCKET HEAD CAP 8-32 X 3/8"	237037101
14	WASHER LOCK INTERNAL TOOTH #6	253008001
15	WASHER LOCK INTERNAL TOOTH #8	253008004
16	WASHER LOCK INTERNAL TOOTH 3/8	253008009
17	TAPE GROUND WIRE TRILOGY	104138

Reference designators are shown on the Front Case Assembly drawing on page 7-28.

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
1	GASKET COMMUNICATION PORT TRILOGY	102218
2	BOTTLE HANGER TRILOGY	102226
3	ASSY CABLE REAR PANEL TRILOGY	102266
4	ASSY CABLE POWER SUPPLY GND TRILOGY	102267
5	ASSY CABLE AC TRILOGY	102270
6	FOOT RUBBER	102278
7	POWER SUPPLY TRILOGY	102304
8	SCREW SOCKET HEAD 6-32 1/4 NYLOK	103239
9	SCREW 8-32 PAN HD SLOT NYLON 3/8	103870
10	SHIELD POWER SUPPLY TRILOGY	103873
11	GROUND STRAP TRILOGY	103874
12	ASSY CABLE LOCKOUT SW GND TRILOGY	103910
13	SHIELD ESD BUZZER TRILOGY	103941
14	CABLE TIE SCREW MOUNT #6	104192
15	SCREW BUTTON HD CAP 4-40 7/16 SS	104534
16	SCREW FLAT HD CAP 10-24 3/4	104536
17	SCREW FLAT HD CAP 4-40 3/8	104538
18	ASSY CABLE BATTERY FUSE TRILOGY	104792
19	ASSY CASE REAR SERVICE	105302
20	ASSY DOOR BATTERY SERVICE	105303
21	NUT HEX 4-40 UNC-2B STEEL	224011022
22	RING RETAINING	213100017
23	SCREW SOCKET HEAD CAP 2-56 3/8	237037005
24	SCREW SOCKET HEAD CAP 4-40 1/4	237037035
25	SCREW SOCKET HEAD CAP 6-32 3/8	237037069
26	SCREW SOCKET HEAD CAP 8-32 3/8	237037101
27	WASHER LOCK INTERNAL TOOTH #6	253008001
28	WASHER LOCK INTERNAL TOOTH #8	253008004
29	WASHER LOCK INTERNAL TOOTH #4	253008005
30	WASHER LOCK INTERNAL TOOTH #2	253008007
31	ADHESIVE THREAD LOCKING LOCTITE 290	232301141
32	WASHER LOCK INTERNAL TOOTH #10	253008002
33	COVER DUST RS232 CONNECTOR	103912
34	PLUG .250" DIA PLASTIC BLACK	103911
35	SCREW SOCKET HEAD CAP 10-32 3/4"	102755
36	ASSY POLE CLAMP SCREW SERVICE	105304
37	WASHER LOCK INTERNAL TOOTH #6	253008001
38	SCREW SOCKET HEAD CAP 6-32 5/8"	237037073
39	ASSY POLE CLAMP (INCLUDES ITEM 36)	102264
40	CORD RETAINER TRILOGY	101951
41	CAP FUSEHOLDER TRILOGY	104794
42	FUSE 3AG 2 AMP	215005036
43	BUZZER EXTRA LOUD CONTINUOUS TONE	102239
44	GASKET TUBE .103 OD CONDUCTIVE	103872
45	ASSY SPEAKER	104227
46	FUSE 2A 250V 5X20MM FAST	105535
Not Shown	BATTERY DOOR BAR	048T000100
Not Shown	BATTERY DOOR BAR SCREW	042J625200

Reference designators are shown on the Rear Case Assembly drawings on pages 7-31 and 7-32.

REFERENCE DESIGNATOR	DESCRIPTION	PART NUMBER
	EXTENDER, COMMON BOARD	102744
	EXTENDER, MICROPROCESSOR BOARD	102745
	EXTENDER, POWER MANAGEMENT BOARD	102746
	TRANSDUCER SIMULATOR	201268000
	TRANSDUCER SIMULATOR CABLE ADAPTER	105509
	VALVELESS CASSETTE TEST SET	105510